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In the Supreme Court of the United States

OCTOBER TERM, A. D. 1927.
BILL IN EQUITY.
ORIGINAL JURISDICTION No. 7.

STATE OF WISCONSIN, STATE OF OHIO, STATE OF PENNSYLVANIA and STATE OF MINNESOTA,
Complainants,

vs.

STATE OF ILLINOIS AND SANITARY DISTRICT OF CHICAGO,
Defendants,

STATE OF MISSOURI, STATE OF TENNESSEE, STATE OF KENTUCKY, STATE OF ARKANSAS, STATE OF MISSISSIPPI AND STATE OF LOUISIANA,
Intervening Defendants.

COMPLAINANTS' EXCEPTIONS TO REPORT OF THE SPECIAL MASTER.

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Attorney General of Wisconsin,

HERMAN L. EKERN,
Special Assistant Attorney General of Wisconsin,

R. T. JACKSON,
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In the Supreme Court of the United States

October Term, A. D. 1927.
Bill in Equity.
Original Jurisdiction No. 7.

State of Wisconsin, State of Ohio,
State of Pennsylvania and State of
Minnesota,
Complainants,

vs.

State of Illinois and Sanitary
District of Chicago,
Defendants,

State of Missouri, State of Tennessee,
State of Kentucky, State of Arkansas,
State of Mississippi and State of Louisiana,
Intervening Defendants.

COMPLAINANTS' EXCEPTIONS TO REPORT OF THE SPECIAL MASTER.

Complainants in the above entitled Original Cause No. 7, jointly and severally, except to the findings of fact made and filed by the Special Master appointed in this case, to the failure or refusal of the Special Master to make and file findings of fact requested by said complainants, to the conclusions of law made and filed by the Special Master, and to the failure of the Special Master to make and file conclusions of law requested by said complainants in the following particulars, to-wit:

EXCEPTIONS TO FINDINGS OF FACT.

I.

Complainants and each of them except to that portion of the finding of fact No. 5(a), appearing on page 18 of the Special Master's Report, which reads as follows, to-wit:

> "In connection with the construction of this canal, the Des Plaines River was straightened for many miles above Lockport, and its channel was improved from Lockport down through Joliet, so that it would be capable of taking the combined floods of the Des Plaines River watershed and the Chicago River watershed, or a total of about 25,000 c. f. s."

because said finding of fact is immaterial, because said finding of fact is contrary to the evidence, and because if this Court should be of the opinion that said finding is material and that it is supported by the evidence, then and in that event, the Special Master should have found and included in said finding of fact that said improvements in the channel of the Des Plaines River, if made, were made for the purpose of facilitating and increasing the abstraction of waters of the Great Lakes-St. Lawrence system for sanitary purposes and not for the benefit of or in aid of navigation.

The portions of the transcript and exhibits in this case which are relied upon by the complainants in support of this exception are set forth in Appendix "A", page 47 hereof.

II.

Complainants and each of them except to that portion of finding of fact No. 5 (f), appearing on page 21 of the report of the Special Master made and filed herein, which reads as follows, to-wit:

"The construction cost of these works, as it appears on the books of the Sanitary District of Chicago, to December 31, 1926, amounted to $83,689,636.52, and, with the addition of administration, legal, clerical, and incidental expenses, and interest on bonds for construction, to $109,021,613.21."

because said finding of fact is immaterial and because said finding of fact is not supported by any competent evidence in that said books and records of the Sanitary District of Chicago were never proved so as to entitle them or any of them to be admitted in evidence and because there is no relation between the reasonable value or cost of the works constructed by said Sanitary District and the sums of money actually expended therefor in that a large portion of said expenditures was the result of fraud, graft, and corruption upon which no equity can be builded or maintained in this Court.

The portions of the transcript and exhibits in this case which are relied upon by the complainants in support of this exception are set forth in Appendix "B", page 49 hereof.

III.

Complainants and each of them except to finding of fact No. 8 (h), made and filed by the Special Master herein and appearing on pages 39 and 40 of said report, which reads as follows, to-wit:

"(h) Permits of July 11, 1900.—In April, 1900, plans were adopted by the board of trustees of the Sanitary District for the deepening and widening of the channels of the Chicago River; and application for permission to do so with respect to a part of the river was made to the Secretary of War on April 26, 1900. On June 7, 1900, a similar application was made with respect to another part of the river. The Secretary of War on July 11, 1900, granted two permits according-

ly, with conditions identical with those of the permit of May 8, 1899. These permits contained this statement:

> "I beg to inform you that there is no objection on the part of the War Department to the prosecution of work of improvement of Chicago River specified in the above-mentioned letter and delineated on the maps which accompanied the same, it being understood that this statement as to the attitude of the War Department shall not be understood as involving the general government in any way with the expense incident to the carrying out of the project, and does not in any way invalidate, waive or affect the right of the Secretary of War to regulate or revoke the permit granted under date of May 8, 1899, to the Sanitary District of Chicago, to divert the waters of the Chicago River and cause them to flow into the artificial channel, such permission being subject to the following conditions'—

the conditions of the former permit already quoted."

because the Special Master should have found and included in the aforesaid finding of fact a finding that all of the work so sought to be done and performed by the Sanitary District of Chicago was solely for the purpose of facilitating and making possible the abstraction of a larger quantity of water from the Great Lakes-St. Lawrence system for sanitary purposes and not for the benefit or in aid of navigation.

The portions of the transcript and exhibits in this case which are relied upon by the complainants in support of this exception are set forth in Appendix "C", page 61 hereof.

IV.

Complainants and each of them except to that part of finding of fact No. 8 (u), made and filed by the Special Master herein and appearing on page 58 of his report, which reads as follows, to-wit:

"The Act of Congress of June 25, 1910 (36 Stat. 659, 660), appropriated $1,000,000 for the construction of a waterway from Lockport, Illinois, to the mouth of the Illinois River, and provided for the appointment by the Secretary of War of a board of five members to report on the feasibility and advisable dimensions of such waterway, and also upon such measures as might be required properly to preserve the levels of the Great Lakes and to compensate, so far as practicable, for the diminished level in these lakes and connecting waters by reason of any diversion of water from Lake Michigan. (The report of this Board, dated August 15, 1913, was transmitted to Congress on February 18, 1914. See Finding 17, *infra*, p. 125.)"

because said finding of fact is immaterial and because if this Court should be of the opinion that said finding of fact is material, then the Special Master should have found and included in said finding of fact a finding that said statute was repealed by the Congress of the United States at a subsequent session of Congress, that no construction work was done under said appropriation, and that no part of said appropriation was expended for construction work prior to the repeal of said statute.

The portions of the transcript and exhibits in this case which are relied upon by the complainants in support of this exception are set forth in Appendix "D", page 74 hereof.

V.

Complainants and each of them except, insofar as the statements hereinafter quoted from finding of fact No. 8(y), made and filed by the Special Master herein and appearing on pages 69, 70 of his report and substantially repeated in a portion of finding of fact No. 16(a) made and filed by the Special Master herein and appearing on page

121 of his report, are intended to be or constitute findings of fact, which said statements and recitals therein, read as follows, to-wit:

> "In his report, Colonel Judson stated that 'for a 9-foot channel, with an increment of 4,167 second feet, the cost either with dams retained or removed appears almost prohibitive, and the probability that Congress will limit the increment to 4,167 second-feet is, in my opinion, so remote that this hypothesis may be left out of consideration. With increments of 7,500 or 10,000 second-feet, the figures show conclusively the advisability of removing all dams." He concluded that, "to most reasonably conform to the probable conditions of the future, an 8-foot project should now be adopted, based on a 7,500 second-foot withdrawal for purposes of estimate and with all dams removed. Then should Congress place the limit of the amount of water to be withdrawn from Lake Michigan at 10,000 second-feet, which I deem probable and, under proper conditions, advisable, that increment would of itself increase the depth to 9 feet. The computations show that with all dams removed, an increment of 10,000 second-feet will increase the depth due to the increment of 7,500 second-feet by about 1.25 feet at Utica, about one foot at Peoria and Havana, and slightly less than one foot at the mouth" (id., pp. 17-19) (Master's Report, pp. 69, 70).
>
> "It will be observed that Colonel Judson stated that 'for a 9-foot channel, with an increment of 4,167 second-feet, the cost either with dams retained or removed appears almost prohibitive,' and his recommendation was for the adoption of an 8-foot project, 'based on a 7,500 second-foot withdrawal for purposes of estimate and with all dams removed.' (Master's Report, p. 121.)"

because if said statements and recitals therein are intended to be findings of fact, they are immaterial, because said report of Colonel Judson was never accepted or acted upon by Congress, and because the recitals of fact in said quota-

tions from Colonel Judson's report are not supported by the evidence in this case but are contrary to the overwhelming preponderance of the evidence in this case.

The portions of the transcript and exhibits in this case which are relied upon by the complainants in support of this exception are set forth in Appendices "E" and "F" pages 79 and 84 hereof.

VI.

Complainants and each of them except to the last sentence of finding of fact No. 8(y), appearing on page 71 of the Master's Report, which reads as follows, to-wit:

> "Before the diversion began in 1900, the official reference datum for Federal improvements and for obtaining and maintaining the established project depth in the Illinois River was the low water of 1879. Since then, this reference datum has been officially changed from time to time, so as to conform to existing low water as affected by the diversion."

because said finding of fact is not supported by any competent evidence in this case and is contrary to all the competent evidence in this case.

The portions of the transcript and exhibits in this case which are relied upon by the complainants in support of this exception are set forth in Appendix "G" page 87 hereof.

VII.

Complainants and each of them except to finding of fact No. 11, made and filed by the Special Master herein, and appearing in his report, pages 81-83, inclusive, which reads as follows, to-wit:

"11. Compliance with conditions of permit of March 3, 1925.—It appears from the evidence that, up to the time of the taking of the testimony herein, the Sanitary District had substantially complied with the conditions of the permit. This is shown by the testimony of Colonel Edward H. Schulz, district engineer of the United States Army at Chicago. With respect to the progress of the Sanitary District in carrying out the program of sewage treatment, Colonel Schulz said:

> "In pursuance of carrying out this permit the drainage district is establishing a North Side treatment plant; has begun work on a West Side treatment plant; had in operation a Des Plaines treatment plant and a Calumet treatment plant, and in connection with the Corn Products Company of Chicago, has rendered treatment of a certain part of the wastes of the Corn Products factory. The proportion down to the present time is fully up to the requirements of the permit for this period, the permit having run now about 22 months."

"The Sanitary District has given a bond running to the United States, in the amount of $1,000,000, for the payment of its share of the cost of regulating or compensating works to restore the levels or compensate for the lowering of the Great Lakes system, if and when constructed.

"With respect to plans for controlling works to prevent the discharge of the Chicago River into Lake Michigan in times of heavy storms, Colonel Schulz testified:

> "In connection with these plans the Sanitary District has consulted the District Engineer Office several times during the past year, and tentative plans have been prepared with a view of placing caisson gates at the mouth of the river. The final plans have not yet been submitted to me, nor have I submitted them to the Secretary of War for approval, but I have no doubt that the work will be finished by about July 1, 1929."

"As to the program for metering the water service of the City of Chicago, Colonel Schulz said:

"The provision of the permit has been carried out up to the present time, up to about 40 per cent of the average for the year. I have been in close touch with the city. It will be noted that this condition is carried out by the city of Chicago, and not by the Drainage District. The requirement involves some 36,000 meters to be placed each year for nine years, first, that they must adopt an ordinance in six months, which they did, and within three months after that, last January, they appropriated $1,000,000 to begin this metering. There had been a good deal of trouble industrially to get the matter started and rapidly executed. The reading of the provision was that 40 per cent should be executed, and that would amount to 14,400 meters, and the average rate 10 per cent. It is evident that the average rate must increase beyond 10 per cent in the next few years to carry out that permit."

"Colonel Schulz testified that there had been compliance with the other conditions of the permit. The permit has not been revoked."

because said finding is not supported by any competent evidence in this case and because said finding of fact is contrary to all competent evidence herein in that it appears affirmatively that the Sanitary District of Chicago has violated the conditions of the permit of March 3, 1925 in the following particulars, to-wit:

(1) that said Sanitary District of Chicago has unreasonably interfered with navigation on the St. Mary's River below St. Mary's Falls, on Lake Michigan, Lake Huron, on the St. Clair River, on Lake St. Clair, on the Detroit River, on Lake Erie, on the Niagara River, on Lake Ontario, and on the St. Lawrence River down to tidewater at the city of Quebec, in violation of condition No. 1 of the permit of March 3, 1925.

(2) that it conclusively appears from the evidence in this case that the Sanitary District of Chicago violated the terms of said permit of March 3, 1925 by on divers occasions exceeding the instantaneous maximum diversion of 11,000 c. f. s.

(3) because the city of Chicago has not provided for the metering of its water service, as required by condition No. 8 of said permit of March 3, 1925, and particularly because since the close of the taking of evidence in this case before the Special Master, appointed by the Court, the city of Chicago has wilfully abandoned and repudiated the program for the installation of meters for its water service, according to the requirements of this permit and has wilfully abandoned and terminated the reading of meters heretofore installed under the provisions of this permit.

The portions of the transcript and exhibits in this case which are relied upon by the complainants in support of this exception are set forth in Appendix "H" page 97 hereof.

VIII.

Complainants and each of them except to that portion of finding of fact No. 16 (a), made and filed by the Special Master herein, which appears on page 119 of his report and which reads as follows, to-wit:

> "If the diversion were reduced materially below 4,167 c. f. s., it would necessitate radical changes in the design and location of the locks, three of which are already either constructed or under construction, and increased outlays."

because said finding of fact is immaterial and because said finding of fact is not supported by any competent evidence herein and is contrary to all competent evidence herein.

The portions of the transcript and exhibits in this case which are relied upon by the complainants in support of

this exception are set forth in Appendix "I", page 128 hereof.

IX.

Complainants and each of them except to that portion of finding of fact No. 16 (a), made and filed by the Special Master herein, and which appears on page 120 of his report and which reads as follows, to-wit:

> "There is no adequate water supply for lockage, except by diversion from Lake Michigan. Other plans would involve prohibitive expense."

because said finding of fact is immaterial and because said finding of fact is contrary to the great weight of the competent evidence in this case.

The portions of the transcript and exhibits in this case which are relied upon by the complainants in support of this exception are set forth in Appendix "J", page 133 hereof.

X.

Complainants and each of them except to that part of finding of fact No. 16 (a), made and filed by the Special Master herein and appearing on page 120 of his report, which reads as follows, to-wit:

> "The Federal project depth has been seven feet; but this could not have been maintained without at least 8,500 c. f. s. from Lake Michigan, which gives, in the lower Illinois, about four feet of the low water depth of seven feet."

because said finding of fact is immaterial and because said finding of fact is not supported by any competent evidence herein and is contrary to the competent evidence in this case.

The portions of the transcript and exhibits in this case which are relied upon by the complainants in support of

this exception are set forth in Appendix "K", page 146 hereof.

XI.

Complainants and each of them except to that part of finding of fact No. 16 (a), made and filed by the Special Master herein, appearing on page 120 of his report, which reads as follows, to-wit:

> "This stretch of the river is adaptable to improvement as an open channel, but if there were no diversion at Chicago, a large amount of improvements and several locks and dams would have to be provided."

because said finding of fact is immaterial and because said finding of fact so far as it implies any necessity of providing additional locks and dams in the absence of diversion is not supported by any competent evidence and is contrary to the great weight of competent evidence herein.

The portions of the transcript and exhibits in this case which are relied upon by the complainants in support of this exception are set forth in Appendices "E" and "F", pages 79 and 84 hereof.

XII.

Complainants and each of them except to that portion of finding of fact No. 16 (a), made and filed by the Special Master herein and appearing on page 122 of his report, which reads as follows, to-wit:

> "The complainants contend that if the water for lockage and navigation purposes of this waterway from Lake Michigan to the mouth of the Illinois River is or should be taken from the Great Lakes-St. Lawrence watershed, a diversion of less than 1,000 c. f. s. of water is sufficient to supply all the needs of navigation. I am unable so to find. The needs of navigation on that waterway will depend upon the carrying out of

> plans already adopted and upon the ultimate decision of Congress with respect to water communication between Lake Michigan and the Mississippi River, the extent to which locks and dams are to be used or installed, that is, the character of the improvements and the amount which it is determined to expend."

because said finding of fact is contrary to the overwhelming weight of the competent evidence in this case.

The portions of the transcript and exhibits in this case which are relied upon by the complainants in support of this exception are set forth in Appendices "E" and "L", pages 79 and 151 hereof.

XIII.

Complainants and each of them except to that part of the finding of fact No. 16 (b), made and filed by the Special Master herein and appearing at page 124 of his report, which reads as follows, to-wit:

> "My conclusion is that the diversion from Lake Michigan through the drainage canal increases to some extent during low water the navigable depths over bars on the Mississippi River, * * *. Upon all the facts, it was permissible for the Secretary of War to reach the conclusion that the diversion from Lake Michigan of 8,500 c. f. s., was to some extent, an aid to the navigation of the Mississippi River in time of low water."

because the Special Master should have found that said diversion from Lake Michigan did not increase the navigable depths over bars on the Mississippi River at low water, because the Special Master should have found that under no circumstances of this case was it possible to reach the conclusion that a diversion from Lake Michigan of 8,500 c. f. s. was to some extent an aid to navigation on the Mississippi River in time of low water, because

said finding of fact is contrary to the overwhelming weight of the competent evidence in this case.

The portions of the transcript and exhibits in this case which are relied upon by the complainants in support of this exception are set forth in appendix "M" page 175 hereof.

XIV.

Complainants and each of them except to that portion of finding of fact No. 16 (b), made and filed by the Special Master herein and appearing on page 125 of his report, which reads as follows, to-wit:

> "It is not controverted that the Secretary of War had these considerations before him, on the application and hearing which resulted in the permit of March 3, 1925."

insofar as said finding of fact implies that the Secretary of War issued the permit of March 3, 1925, in any degree whatever for the purpose of aiding or benefiting navigation on the Mississippi River or for any other purposes than assisting the Sanitary District of Chicago in the disposal of the sewage of that district, because said finding of fact is immaterial, because said finding of fact is not supported by any competent evidence and because said finding of fact is contrary to all the competent evidence in this case.

The portions of the transcript and exhibits in this case which are relied upon by the complainants in support of this exception are set forth in appendix "N," page 210 hereof and page 204 of appendix "M."

XV.

Complainants and each of them except to each and every part of finding of fact No. 17, made and filed by the Special Master herein and appearing in his report on pages

125-131, inclusive, to each and every recital contained therein insofar as such recitals, or any of them, are intended to be or constitute a finding of fact, which finding and recitals *in haec verba* read as follows:

"17. Feasibility of remedial works to offset the effect of the Chicago diversion.—One of the conditions of the permit of March 3, 1925, was that the Sanitary District should pay its share of regulating or compensating works, to restore the levels, or compensate for the lowering of the levels of the Great Lakes system, if and when constructed, and post a guaranty in the way of a bond or certified check, in the amount of $1,000,000, as an evidence of its good faith. From an engineering standpoint, the evidence shows it to be practicable to provide such works. This question has been the subject of inquiry by Congress, and of reports pursuant to its direction (Report of Board of Engineers on Deep Waterways, June 30, 1900; House Doc. 149, 56th Cong., 3rd sess.; International Waterways Commission, 1907, House Doc. 779, 61st Cong., 2nd Sess.).

"The Act of Congress of June 25, 1910, provided for a special board of engineers, to report upon a waterway from Utica, Ill., to the mouth of the Illinois River, and upon such measures as might be required to compensate for diminished level, by means of any diversion of water from Lake Michigan for the maintenance of the proposed waterway, or diversion for any other purpose. The report (August 15, 1913) of this Board, with the report of the Board of Engineers for Rivers and Harbors (December 16, 1913), was transmitted to Congress on February 18, 1914 (House Doc. 762, 63rd Cong., 2nd sess.). The special board reported as follows (id., pp. 11, *et seq.*):

"To restore the diminished levels in the lakes by constructing contracting works in their outlets does not, however, present any serious difficulties. A careful discussion of the proper locations and dimensions of such works is also given in Appendix A.

"At the foot of Lake Ontario, the closure of the Gut channel of the Galops Rapids by the Canadian Government has had the effect of raising the level of Lake Ontario an amount nearly equal to the computed lowering of the Lake by a diversion of 10,000 second-feet at Chicago, and no compensation is at present deemed necessary to restore former conditions in this Lake.

"In Appendix A, it is proposed to diminish the outflow of Lake Erie, by the construction of three submerged weirs in the Niagara River in the vicinity of Squaw Island, which would average about 4.2 feet in height, and would contain about 15,000 cubic yards of masonry. The estimate cost is $150,000.

"To raise the level of Lakes Michigan and Huron, submerged weirs are proposed in St. Clair River, covering three miles of river below the mouth of Black River, at Port Huron. The weirs as suggested in Appendix A have a height of from five to six feet above the river bed, contain about 65,000 cubic yards of material, and their estimated cost is $325,000. It is computed that these weirs will increase the velocity of the water flowing over them slightly (from a mean of 3.28 feet to 3.89 feet per second) but on the other hand, above the mouth of Black River, the river slopes and velocities which are now excessive, will be diminished and navigation on the whole will be considerably benefited.

"The Chicago diversion has no effect on Lake Superior.

"Compensation for the loss of elevation on Lakes Michigan, Huron and Erie, and their connecting waters, due to an assumed diversion from Lake Michigan of 10,000 second-feet, will, by the plan above outlined, involve an expenditure of about $475,000, to which should be added an amount for the maintenance of the weirs, estimated at about $15,000 per year, the total cost being much less than the cost of restoration of depths by dredging. It is the opinion of the board that while other plans have

been proposed, compensation by fixed contraction works, similar in general to those above described, affords the cheapest and most satisfactory method of preserving the levels of the Great Lakes."

"The Warren report (*supra*, p. 66) recommended a system of submerged weirs to repair the damage caused to Lake St. Clair, the St. Clair River, and Lakes Huron and Michigan through the lowering of the levels of these waters. Colonel Warren stated (p. 90):

"128. There are three general methods by which a restoration of depths on the lakes may be sought—first, the deepening of all harbors and channels affected by the artificial lowering of water levels; second, the construction of regulating works in the outlets of the lakes to raise the levels of the lakes and to control their elevations within fixed limits; third, the contraction of the outlets by means of fixed obstructions which will raise the levels of the lakes without greatly affecting their natural fluctuations.

"129. The first method is considered altogether too expensive, and has other unsatisfactory features. It is recommended only for a few special cases. The second has frequently been proposed, but upon investigation it is found to be less simple than it appears. It involves obstruction to navigation and difficulties with ice. Moreover, it has been shown that efficient regulation of one lake tends to aggrevate the fluctuation of those below it. This system has been adopted at the Soo, where circumstances are particularly favorable to it, but its suitability for the lower lakes is problematical. The third method is the cheapest and simplest, and is considered the most desirable. It is already operating successfully in the case of the Gut Dam.

"130. In Section G 7 of Appendix E the works needed at various places to compensate for the effects of all diversions, present or prospective, are considered in some detail. It is concluded that the

project is entirely feasible and that the expense will not be excessive in view of the benefits received. The works involved include wing walls or other methods of narrowing the channels at the head of each of the St. Lawrence Rapids, a long submerged rock weir about the rapids at Niagara Falls, and a series of such weirs near the head of Niagara River and in the upper reaches of the St. Clair River. To effect the required deepening in Lake St. Clair, and at the head of the Detroit River it was thought that dredging would be the most satisfactory."

"The Board of Engineers for Rivers and Harbors, commenting upon this recommendation of Colonel Warren, said (id. p. 44):

"The division engineer rejects the first and third plans for restoring levels and proposes to restore the levels of Lakes Erie, Huron, and Michigan by the construction of two sets of submerged weirs. One set of five would be at the head of the Niagara River abreast of Squaw Island, cost about $2,000,000, and raise Lake Erie 1.27 feet, Lake St. Clair about 0.55 foot, and Lakes Huron and Michigan about 0.16 foot, leaving 0.28 foot to be compensated by dredging in Lake St. Clair. The second set of about 11 weirs, spaced about one-third mile apart in the St. Clair River, would cost $1,500,000 and would raise Lakes Huron and Michigan 0.60 foot more. The levels of these three lakes and the connecting rivers between them would, at a total cost of about $3,660,000, be not only fully restored, but provision made for the lowering that would be caused by some additional diversion, the margin on Lake Erie being 0.51 foot and on Lakes Huron and Michigan 0.29 foot.

"85. These submerged weirs would leave the natural oscillation of Lakes Erie and Huron undisturbed. They would reduce the discharge capacity of the St. Clair and Niagara Rivers to what it was before any diversions or other artificial changes were made and permit the lakes to fluctuate between such levels as would have resulted from purely

natural causes, such as changes in precipitation, evaporation, etc. To design the weirs correctly, proper model experiments would be desirable and also prolonged gauge observation. In other respects, the weirs are a sound and workable solution of the problem of improving navigable depths, in some respects preferable at the time they are recommended to any other plan."

"The Joint Board of Engineers, United States and Canada, in its report of November 16, 1926 (*supra*, p. 96), stated (pp. 14, 17):

"78. The levels of the Great Lakes can be raised by works in their outlet rivers, which may be wholly in the form of fixed weirs and contractions, or may be provided with sluice gates. The first of these have come to be termed 'compensating works,' while the second are termed 'regulating works.'

"79. The effect of compensating works is to raise both the high and low lake levels in substantially the same degree, the fluctuation of levels remaining unchanged. After the lake levels have adjusted themselves to the new regimen of the outlet, the outflow from the lake will likewise be substantially the same as if the compensating works had not been built. By operating the gates of regulating works the discharge from a lake, and consequently the levels of the lake, can be controlled within limits to be discussed later.

* * * * *

"95. The investigations made by the Board show that it is advisable to construct compensating works in the Niagara and St. Clair Rivers to counteract the effect of all diversions and outlet enlargements on the levels of Lakes Michigan, Huron and Erie."

"The Board then describes the works proposed in the Niagara River and St. Clair River. The cost of the works proposed on the Niagara River is estimated at about $700,000 and on the St. Clair River, $2,700,000. The report then continues (id., pp. 17, 18):

"98. This form of compensating works is selected primarily for the reason that the sills will not reduce the navigable width of this important waterway" (St. Clair River) "nor will they increase the cost of providing a channel depth of 30 feet. While these works once built cannot be altered readily to meet a future reduction in the amount of the Chicago diversion, yet on account of the commercial value of the gravel in the river bed it would not be costly to again enlarge the capacity of the river to meet such a reduction.

"99. Construction periods.—To avoid an unwarranted reduction in the flow of the Niagara and St. Lawrence Rivers while the lakes are being raised by the compensating works, the construction on the Niagara River should be spread over two years and on the St. Clair River over four years' time, and the prosecution of the latter should be suspended during any extreme low water periods that may occur at the time that they are undertaken.

"100. Compensation for authorized diversions only.—The proposed compensating works will counteract not only the effect of diversions authorized by license in the United States and Canada but also the effect of outlet enlargements, diversions for navigation, and diversions not covered by license. The lake levels could be restored by similar but less extensive works to the extent that they have been reduced by diversions authorized by license in the two countries. The cost of such works would be nearly proportional to the amount of compensation of level affected, and is estimated as follows:

Diversion compensated for	Cost of works in Niagara River	Cost of works in St. Clair River
Chicago Sanitary District	$400,000	$1,350.000
Power diversions, Welland Canal	100,000	.....”

"By the instructions given to the Joint Board of Engineers by the Governments of the United States and Canada, the Board was directed to answer the following questions (id., p. 43):

"Question 6 (B).—By what measures could the water levels of navigable depths affected by the diversions referred to in Section 6 (A)" (which included diversion at Chicago of 8,500 c.f.s. through the drainage canal) "be restored, and what would be the cost thereof?"

"The Joint Board answered as follows:

"240. Answer.—The water levels of Lakes Michigan, Huron and Erie can be restored most advantageously by compensating works in the St. Clair and Niagara Rivers, which should, however, be so designed as to offset all existing diversions and outlet enlargements, as well as the diversions authorized by license. The total cost of these works is estimated at $3,400,000. The cost of similar but less extensive works, designed to restore the effect of authorized diversions only, is estimated as follows:

Diversion compensated for	Cost of works
Chicago Diversion	$1,750,000
Power diversions, Welland Canal	100,000

"241. The effect of the diversions on the levels of Lake Ontario and of the St. Lawrence River above Montreal, will be removed by the works provided for the improvement of this part of the St. Lawrence.

"242. The effect of the authorized diversions on the levels of the St. Lawrence River at and below Montreal can be restored by dredging and accessory works at estimated costs as follows:

Dredging Montreal Harbor	654,000
Reconstruction of dock walls, Montreal Harbor	1,800,000
Dredging below Montreal	2,154,000
Total	$4,608,000"

because said finding of fact and the recitals therein contained are irrelevant and immaterial because:

(1) the construction of compensating works in the Great Lakes and their connecting waters is dependent upon the consent and authorization of the Congress of the United States and solely under its control and not within the control of either the complainants or defendants herein, and when or if the Congress of the United States will ever act with reference to said compensating works is not known

(2) because construction of compensating works in the Great Lakes and their connecting waters is dependent upon the consent and joint action of the Kingdom of Great Britain and when or if the government of the Kingdom of Great Britain will ever act with reference to or consent to the construction of compensating works in said waters is not within the control of the complainants or defendants herein and is not known

(3) because the complainants are not required as a matter of law to construct compensating works for the purpose of minimizing the damages inflicted upon them by the creation and maintenance of the nuisance involved herein by the defendants, and

because said finding of fact and the recitals therein are not supported by any competent evidence in this case and because if this Court should be of the opinion that said finding of fact and the recitals therein, or any of them, is or are material and is or are supported by any competent evidence

in this case, then and in that event the Special Master should have found and included in said finding the following conclusions, to-wit:

(1) that some of the damages caused by said nuisance and abstraction of waters from the Great Lakes-St. Lawrence system by the defendants could not be mitigated or minimized by the construction of compensating works;

(2) that with respect to such damages as could be mitigated or minimized by the construction of compensating works and all other matters affecting the beneficial use of these waters, conditions would be better with the construction of such compensating works and no diversion from Lake Michigan by the defendants than such conditions would be with the construction of such compensating works and the continuation of the diversion or abstraction from Lake Michigan by the defendants;

(3) that the complainant states and their peoples are entitled to the full benefit which might be obtained by reason of the construction of compensating works in the Great Lakes and their connecting waters free from diminution by reason of the nuisance and abstraction created and maintained by the defendants herein.

The portions of the transcript and exhibits in this case which are relied upon by the complainants in support of this exception are set forth in Appendix "O," page 225 hereof.

XVI.

Complainants and each of them except to that portion of finding of fact No. 18 made and filed by the Special Master herein and appearing on pages 137 and 138 of his report, which reads as follows, to-wit:

"The other lake cities, however, by the aid of their sewage disposal works had cut down their rate, so that, in the years 1920 to 1925, it was 1.81 at Milwaukee; 6.10 at Detroit; 2.17 at Cleveland; 4.05 at Buffalo; and 1.83 at Rochester."

insofar as said finding of fact implies that the reduction in the typhoid fever date rate at Milwaukee, Detroit, Cleveland, Buffalo and Rochester during the period covered by the table upon which said finding of fact is based reveals or measures the effectiveness of sewage disposal and water purification works in the control of typhoid fever death rates because the Special Master should have found that said reduction in the typhoid fever death rate in these cities was accomplished under conditions ranging from one of no treatment of sewage and no water purification plants to partial treatment of sewage and partial filtration or purification of the water supply, but in no instance with complete treatment of the sewage coupled with filtration or purification of the whole water supply and that a greater reduction in the typhoid fever death rate in said cities could or would be affected by the installation of complete sewage disposal and water purification works.

The portions of the transcript and exhibits in this case which are relied upon by the complainants in support of this exception are set forth in Appendix "P" page 227 hereof.

XVII.

Complainants and each of them except to the statement made and filed by the Special Master herein, appearing on page 165 of his report, insofar as by the reference to finding of fact No. 7 (b) contained in and appearing at pages 25 and 26 of the Special Master's report, it is intended to be or is construed as a finding of fact and which reads as follows:

"So far as the diverted water is used for the development of power, the use is merely incidental (*supra*, p. 25)."

because if said statement is intended to be or is construed as a finding of fact, it is contrary to all competent evidence herein and not supported by any competent evidence in this case.

The portions of the transcript and exhibits in this case which are relied upon by the complainants in support of this exception are set forth in Appendix "Q," page 230 hereof.

EXCEPTIONS TO FAILURE OR REFUSAL OF SPECIAL MASTER TO GRANT FINDINGS OF FACT REQUESTED BY OR ON BEHALF OF THE COMPLAINANTS:

XVII.

Complainants and each of them except to the failure or refusal of the Special Master to find or grant that part of complainant's requested finding of fact No. 7, appearing on page 8 of complainant's requested findings of fact, which reads as follows, to-wit:

"(In 1870, the State of Illinois adopted a new constitution which provided in Separate Section 3, that the General Assembly should never loan the credit of the state or make appropriations for the aid of railways or canals. (Exhibit 5, Tr. 209.))"

The portions of the transcript and exhibits in this case which are relied upon by the complainants in support of this exception are set forth on page 267 of Appendix "R" hereof.

XIX.

Complainants and each of them except to the failure or refusal of the Special Master to find or grant that part of the complainant's requested finding of fact No. 7, appearing on page 9 of complainant's requested findings of fact, which reads as follows:

> "In 1887, the legislature of Illinois adopted a joint resolution, appearing in the Laws of Illinois, 1887, page 314, reciting the plan of Chicago to transfer its sewage into the Desplaines and Illinois Rivers and expressing the opinion that such a plan was dangerous to the people of the Illinois Valley by reason of sewage pollution and by reason of disastrous overflows and providing for the appointment of a committee to investigate and report. (Exhibit 7, Tr. 217-218.)"

The portion of the transcript and exhibits in this case which are relied upon by the complainants in support of this exception are set forth on pages 271-272 of Appendix "R" hereof.

XX.

Complainants and each of them except to the failure or refusal of the Special Master to find or grant that part of the complainant's requested finding of fact No. 7, appearing on pages 16 to 18, inclusive, of complainant's requested findings of fact, which reads as follows, to-wit:

> "On April 24, 1899 the then United States District Engineer at Chicago, pursuant to direction, reported to the Chief of Engineers upon the foregoing application. The material portions of his report are as follows:
>
> "* * * It is a strange fact that this city has expended, or will expend, over $30,000,000 with the intention of diverting an apparently unlimited amount of water from the Great Lakes to the Mississippi drainage area for sanitary purposes without finding out whether such diversion would be allowed by the

great interests of the United States and the Colonies of Great Britain along the chain of Great Lakes in the navigation of the rivers and harbors of the Great Lakes. Now they ask the authority of an executive officer of the United States to open a channel that will to some unknown extent lower the levels of all the Great Lakes below Lake Superior and their outlets, introduce a current also unknown and not to be ascertained otherwise than by actual experiment, in the Chicago River, the most important navigable river of its length on the Globe, but which is already obstructed by bridges, masses of masonry and bends, and of difficult navigation at best.

"The possible effects of this diversion are not known, further than that to some unknown degree they will be injurious. Whether the amount of this injury will be so small as to be accepted by the interests affected in view of the manifest advantages to and apparent necessities of their neighbors, cannot be determined by other than the interests themselves.

"It is clear to me that I am not competent to make a recommendation as to what should ultimately and definitely be done.

"* * * In my opinion the abstraction of from 300,000 to 600,000 cubic feet per minute will permanently lower Michigan, Huron and Erie from 3 to 8 inches; not more than 8 nor less than 3 inches, corresponding to an extreme reduction of from 160 to 466 tons in carrying capacity of the large vessels of the Lakes, and that it will take from three to four years for this full effect to be attained. But the State law is unlimited in its requirements. 20,000 cubic feet per minute must be taken from Lake Michigan for each 100,000 population of the district; already nearly 400,000 c. ft. must be taken, and at the same ratio of increase for a few decades, in a very short time there must be taken 1,000,000 c. ft. per minute under this indefinite law. The amount should be limited and the injurious effect stopped somewhere.

"The mean current to be introduced in Chicago River upon the opening of the canal is estimated by the Engineers of the Drainage Board at one and one-fourth miles per hour or 110 ft. per minute. This is simply an assumption that with such velocity in an unobstructed river, the amount of 300,000 cubic feet per minute can be discharged through Chicago River but I have seen this River so jammed with vessels, drawing all the water that is in it, that by leaping from deck to deck I could cross the river. What the velocity would be in such condition with Lake Michigan on one side and a great fall on the other side of such vessels, no one knows. But it is a simple mathematical problem to determine the effect on steel-plate vessels of from 2,000 to 4,000 tons mass drifting upon or striking stone piers with a velocity of near two feet a second. They will go to the bottom.

"* * * Yet I may venture to suggest that the entire subject be referred to Congress for final solution, and that a conditional permit or authority be granted to the authorities of the Chicago Sanitary District by the War Department, awaiting action by Congress, to open their channel, and under the following conditions:

"1st: That if, at any time, it becomes apparent that the current created by such drainage works in the South and Main Branches of Chicago River, be unreasonably obstructive to navigation or injurious to property, the Secretary of War reserves the right to close said discharge through said channel or to modify it to such extent as may be demanded by navigation and property interests along said Chicago River and its South Branch.

"2nd: That the Sanitary District of Chicago must assume all responsibility for damages to property and navigation interests by reason of the introduction of a current in Chicago River.

"With 300,000 cubic feet per minute discharge it will take one year to lower the level of Lake

Michigan and Huron one-tenth of a foot, and several years to reach the maximum permanent effect of this discharge, which will not probably much exceed three inches, so that the main injury to navigation, if any, that can be expected before action by Congress, will be in Chicago River, and that can be at once abated.

"All the changes made by the Sanitary District of Chicago, taken by themselves, have been such as to increase the navigable capacity of Chicago River. Taken in connection with the current to be introduced I am not able to say that the river will be as navigable as it was before these changes were made. The changes materially lessen the probable injury to navigation of this current, at the points where the changes have been or will be made."

(Doc. 7, Exhibit 12, Tr. 243-248.)

The portions of the transcript and exhibits in this case which are relied upon by the complainants in support of this exception are set forth on pages 280-282 of Appendix "R" hereof.

XXI.

Complainants and each of them except to the failure or refusal of the Special Master to find or grant that part of the complainant's finding of fact No. 7, appearing on pages 20 and 21 of the complainant's requested findings of fact, which reads as follows, to-wit:

"Under date of July 15, 1901 the Sanitary District of Chicago made application for permission to flow 300,000 cubic feet of water per minute between the hours of 4 P. M. and 12 o clock midnight for the purpose of sewage disposal, on the ground that such an increased flow during the period in question would not injure navigation, as the effect upon the currents would be confined to the period extending from 12 o'clock, midnight to 6 A. M. of the following day. (Tr. 268-270, Doc. 13 of Exhibit 12.)"

because a finding of the Special Master with respect to said permit of July 15, 1901, appearing on pages 41 and 42 of the report of the Special Master filed herein, fails to disclose that the request for said permit and said permit were based upon an enlarged diversion from 12 o'clock, midnight, to 6 A. M. of the following day solely for the benefit of sewage disposal on the ground that there was no navigation during those hours and navigation would not be further injured by such increase.

The portions of the transcript and exhibits in this case which are relied upon by the complainants in support of this exception are set forth on pages 292-295 of Exhibit "R" hereof.

XXII.

Complainants and each of them except to the failure or refusal of the Special Master to find or grant that part of the complainant's finding of fact No. 7, appearing on page 23 of the complainant's requested findings of fact, which reads as follows, to-wit:

> "The reversal of the Chicago River changed its slope and reduced the navigable depths from the Lake upstream in the main river and the North and South channels. The loss in depth was more than restored in the main stream and in the South branch of the Chicago River by the excavations of the Sanitary District which enlarged those portions of the Chicago River to a width of 200 feet and central depth of 26 feet in order to facilitate the flow of the large volume of water required for the dilution of sewage discharged into the Drainage Canal. The North fork of the Chicago River and the South fork of the South branch were not deepened by the Sanitary District and their navigable depths were reduced. The impairment of the depths in the South fork was serious in extent. The use of the river as the main sewer of Chicago subjected it to de-

teriorating influences as a navigable channel. The District Engineer recommended the abandonment of the maintenance of portions of the Chicago River theretofore under improvement by the Federal Government, because of their use as sewers with the attendant filling in of the channels, on the ground that the maintenance of such channels for sewer purposes was an obligation of the City or Sanitary District and not of the Federal Government. (Exhibit 13, Tr. 292-293.)"

The portions of the transcript and exhibits in this case which are relied upon by the complainants in support of this exception are set forth on pages 305-306 of Appendix "R" hereof.

XXIII.

Complainants and each of them except to the failure or refusal of the Special Master to find or grant that finding of fact contained in the last sentence of that part of the complainant's finding of fact No. 7, appearing on pages 24 and 25 of complainant's requested findings of fact, which reads as follows, to-wit:

"Pursuant to this recommendation, under date of January 17, 1903, the Secretary of War granted permission to increase the flow through the Chicago River to 350,000 cubic feet per minute until March 31, 1903, after which it should be reduced to 250,000 cubic feet per minute, upon the following conditions:

"1. That the permission herein given shall be subject to such modification as in the opinion of the Secretary of War the public interests may from time to time require.

"2. That said Sanitary District of Chicago shall be responsible for all damages inflicted upon navigation interests by reason of the increase of flow herein authorized." (Doc. 24, Exhibit 12, Tr. 302-304.)

"The foregoing increase was solely for sanitary purposes during the closed season of navigation."

The portions of the transcript and exhibits in this case which are relied upon by the complainants in support of this exception are set forth on pages 307-311 of Appendix "R" hereof.

XXIV.

Complainants and each of them except to the failure or refusal of the Special Master to grant or find complainants' finding of fact No. 9, appearing on page 44 of complainants' requested findings of fact, which reads as follows, to-wit:

"IX. All of these abstractions of and requests for consent of Secretary of War to the abstraction of the waters of the Great Lakes-St. Lawrence system by the Sanitary District of Chicago have been for the purpose of sewage disposal and power development."

The portions of the transcript and exhibits in this case which are relied upon by the complainants in support of this exception are set forth in Appendices "Q" and "R," pages 230 and 267 hereof.

XXV.

Complainants and each of them except to the failure or refusal of the Special Master to grant or find complainants' finding of fact No. 10, appearing on pages 44 and 45 of complainant's requested finding of fact, which reads as follows, to-wit:

"X. The Congress of the United States has never authorized any diversion of water from the Great Lakes-St. Lawrence watershed at Chicago through the Chicago Drainage Canal for any purpose. None of the Secretaries of War of the United States or other Federal executive officers has authorized or directed

any diversion of water from the Great Lakes-St. Lawrence watershed to the Mississippi watershed by way of the Chicago Drainage Canal for purposes of navigation. All consents or permits which have been issued or granted by any of the various Secretaries of War of the United States have been granted or issued at the request of the Sanitary District of Chicago for sewage disposal purposes. All such permits have been temporary and revocable in character and conditioned that there should be no interference with or injury to navigation. They have been reluctantly granted to meet a case of alleged sanitary necessity with obvious fear that great damage would be done to navigation and other interests."

The portions of the transcript and exhibits in this case which are relied upon by the complainants in support of this exception are set forth in Appendices "Q" and "R", pages 230 and 267 hereof.

XXVI.

Complainants and each of them except to the failure or refusal of the Special Master to grant or find complainant's finding of fact No. 14, appearing on page 47 of complainant's requested findings of fact, which reads as follows, to-wit:

"XIV. From April 1, 1903, to March 3, 1925, the Sanitary District of Chicago knowingly and intentionally violated all of the Permits of the Secretaries of War and asserted the right to abstract unlimited quantities of water from the Great Lakes-St. Lawrence System without the consent and in defiance of the government of the United States and of the other states bordering on that waterway. (Exhibit 1111, Tr. 3360.)"

The portions of the transcript and exhibits in this case which are relied upon by the complainants in support of this exception are set forth in Appendix "S" page 372, and page 338 Appendix "R" hereof.

XXVII.

Complainants and each of them except to the failure or refusal of the Special Master to find or grant that part of the complainant's requested finding of fact No. 95, appearing on page 100 of complainant's requested findings of fact, which reads as follows, to-wit:

> "No abstraction or diversion of the waters of the Great Lakes-St. Lawrence system is necessary to provide a nine-foot channel for navigation purposes from Lake Michigan by way of the drainage canal, the proposed Illinois waterway and the Illinois River to the mouth of the Illinois River. (Tr. 2117-2123, 2127-2128.)"

The portion of the transcript and exhibits in this case which are relied upon by the complainants in support of this exception are set forth in Appendices "G" and "L" pages 89 and 151 hereof.

XXVIII.

Complainants and each of them except to the failure or refusal of the Special Master to find or grant that part of the complainant's requested finding of fact No. 95, appearing on pages 100 and 101 of complainant's requested findings of fact, which reads as follows:

> "If the water for lockage and navigation purposes on this waterway from Lake Michigan to the mouth of the Illinois River is or should be taken from the Great Lakes-St. Lawrence watershed, a diversion or abstraction of less than 1,000 second feet of water from said watershed is sufficient to supply all of the needs of navigation for said waterway. No water is needed for navigation purposes during a considerable portion of the winter season when navigation is closed. (Exhibit 102, page 33.) Any diversion or abstraction of the

water of the Great Lakes-St. Lawrence system in excess of 1,000 second feet through the waterway from Lake Michigan to the mouth of the Illinois River is for the purpose of power development or sewage disposal, or both, and not for the needs of navigation. (Tr. 6812, 6813, 1269, 2116-2117, 6993, 389, 383, 399-400, 8039-8040, 2126-2127, Exhibits 62, 182, 209, Documents 40-41 of Exhibit 12.)"

The portions of the transcript and exhibits in this case which are relied upon by the complainants in support of this exception are set forth in Appendices "G," "L," "Q" and "R" pages 89, 151, 230 and 267 hereof.

XXIX.

Complainants and each of them except to the failure or refusal of the Special Master to find or grant complainant's finding of fact No. 104, appearing on page 104 of complainant's requested findings of fact, which reads as follows, to-wit:

"CIV. The Sanitary District of Chicago has violated the conditions of the permit of March 3, 1925, by exceeding the limitation placed by that permit upon an instantaneous maximum diversion and by causing and continuing an unreasonable interference with navigation in the Chicago River and in all of the waters of the Great Lakes, their connecting waters and their outlet river, from St. Mary's Falls in the St. Mary's River to tidewater in the St. Lawrence River at Quebec. (Exhibit 146.)"

The portions of the transcript and exhibits in this case which are relied upon by the complainants in support of this exception are set forth in Appendix "H," page 97 hereof.

EXCEPTIONS TO CONCLUSIONS OF LAW.

I.

Complainants and each of them except to the second conclusion of law made and filed by the Special Master herein, appearing on page 148 of his report, to-wit:

> "My conclusion is that the action of Illinois in diverting water from Lake Michigan through the drainage canal of the Sanitary District, was, and is, unlawful unless validly permitted by Congress either directly or through the action of the Secretary of War."

and appearing in the summary of conclusions of the Special Master's Report, page 196, *in haec verba,* to-wit:

> "2. That the State of Illinois and the Sanitary District of Chicago have no authority to make or continue the diversion in question without the consent of the United States."

insofar and to the extent that said conclusion of law implies or holds that the United States might authorize the State of Illinois and the Sanitary District of Chicago, or either of them, to make or continue the diversion in question under the circumstances of this case.

II.

Complainants and each of them except to the third conclusion of law made and filed by the Special Master herein and stated by him on page 196 of his report, to-wit:

> "3. That Congress has power to regulate the diversion, that is, to determine whether and to what extent it should be permitted."

III.

Complainants and each of them except to the conclusion of law made and filed by the Special Master herein, designated as Third (1) which is summarized by the Special Master on page 152 of his report, to-wit:

"The decisions which have been cited, and the principle they apply, seem to me to dispose of the contention that, in this instance, if it be assumed that the diversion has been authorized under action of Congress, otherwise competent, the property of the complainant states has been taken in violation of the Fifth Amendment. Where, pursuant to governmental authorization otherwise valid, there is an abstraction of water from navigable lakes and rivers and a consequent lowering of levels by enlarging or opening outlets, the incidental damage to riparian owners affords no ground for asserting the constitutional invalidity of that action. Great Lakes as riparian owners, as well as individuals, are subject to the authority of Congress, and they have no ownership in navigable waters which they can assert in opposition to the exercise of that authority."

in so far and to the extent that said conclusion of law implies or holds that the Congress of the United States has authority to inflict the damages upon the complainant states and their people established in this case and under the circumstances of this case without violating the Fifth Amendment to the Constitution of the United States.

IV.

Complainants and each of them except to the conclusion of law designated as Third (2) made and filed by the Special Master herein and summarized by the Special Master on page 158 of his report, to-wit:

"It seems to me that the authority of Congress to regulate the diversion in the present instance is not to be denied merely because the water is taken from one watershed to another."

V.

Complainants and each of them except to the conclusion of law designated as Third (3) made and filed by the

Special Master herein and summarized by the Special Master on page 160 of his report, to-wit:

> "I am of the opinion that the diversion in the present case, if otherwise lawfully authorized, cannot be regarded as beyond the power of Congress, as an unconstitutional preference of ports."

VI.

Complainants, and each of them, except to the conclusion of law designated as Third (4) made and filed by the Special Master herein appearing in the report of the Special Master on pages 160-165 inclusive, wherein and to the extent that the Master concludes that the power of Congress to protect and improve navigation includes power in Congress to destroy, or to create obstructions to, navigable capacity, or that action by Congress which does destroy navigation or create obstructions to navigable capacity is not judicially reviewable under the circumstances of this case.

VII.

Complainants, and each of them, except to the conclusion of law designated as Third (5) made and filed by the Special Master herein, and appearing on pages 165-171 insofar as the Master therein concludes and holds that under the circumstances of this case, Congress has power to authorize the diversion here shown for sanitary purposes under the commerce clause of the Constitution of the United States.

VIII.

Complainants and each of them except to the Fifth conclusion of law made and filed by the Special Master herein and appearing on pages 176-191, inclusive, of his report and

summarized by the Special Master at page 196 of his report, to-wit:

> "5. That Congress has conferred authority upon the Secretary of War to regulate the diversion, provided he acts in reasonable relation to the purpose of his delegated authority and not arbitrarily."

insofar and to the extent that it implies or holds that the Congress of the United States has empowered the Secretary of War to authorize the instant diversion under the circumstances of this case.

IX.

Complainants and each of them except to the Sixth conclusion of law made and filed by the Special Master herein and appearing on pages 191-196, inclusive, of the Special Master's report and appearing in the summary of conclusions of the Special Master on page 196 of his report, to-wit:

> "6. That the permit of March 3, 1925, is valid and effective according to its terms, the entire control of the diversion remaining with Congress."

X.

Complainants and each of them except to that part of the recommendation for a decree made and filed by the Special Master herein, which reads as follows, to-wit:

> "In the light of these conclusions, the bill, in my opinion, should be dismissed."

EXCEPTIONS TO FAILURE OR REFUSAL OF SPECIAL MASTER TO GRANT COMPLAINANT'S REQUESTED CONCLUSIONS OF LAW.

XI.

Complainants and each of them except to the failure or refusal of Special Master appointed herein to grant complainant's requested conclusion of law No. 17, appearing on page 109 of complainant's requested findings of fact, conclusions of law, and recommendations for a decree, which reads as follows, to-wit:

> "(17) That the Congress of the United States is without power to authorize the abstraction and transfer of the waters of the Great Lakes-St. Lawrence watershed to or for the benefit of the Mississippi River watershed."

XII.

Complainants and each of them except to the failure or refusal of Special Master appointed herein to grant complainant's requested conclusion of law No. 19, appearing on page 109 of complainant's requested findings of fact, conclusions of law, and recommendations for a decree, which reads as follows, to-wit:

> "(19) That neither the plans for the building nor the construction of the Chicago Drainage Canal was ever recommended by the Chief of Engineers or authorized by the Secretary of War prior to or since the commencement of construction."

XIII.

Complainants and each of them except to the failure or refusal of Special Master appointed herein to grant complainant's requested conclusion of law No. 20, appearing on page 109 of complainant's requested findings of fact,

conclusions of law, and recommendations for a decree, which reads as follows, to-wit:

"(20) That the Permit of March 3, 1925 is *ultra vires* and void and constitutes no authority for the abstraction of the waters of the Great Lakes-St. Lawrence system by the State of Illinois and the Sanitary District of Chicago."

XIV.

Complainants and each of them except to the failure or refusal of Special Master appointed herein to grant complainant's requested conclusion of law No. 21, appearing on page 109 of complainant's requested findings of fact, conclusions of law, and recommendations for a decree, which reads as follows, to-wit:

"(21) That all of the prior Permits by the Secretary of War were and are *ultra vires* and void, and constitute no authority for the abstraction of the waters of the Great Lakes-St. Lawrence system by the State of Illinois and the Sanitary District of Chicago, or either of them."

XV.

Complainants and each of them except to the failure or refusal of Special Master appointed herein to grant complainant's requested conclusion of law No. 22, appearing on page 109 of complainant's requested findings of fact, conclusions of law, and recommendations for a decree, which reads as follows, to-wit:

"(22) That the Permit of March 3, 1925, does not purport to authorize the abstraction of the waters of the Great Lakes-St. Lawrence system, and does not undertake to authorize the invasion or injury of the property and rights of the peoples of all the complainant states or the proprietary or quasi-sovereign rights of said complainant states."

XVI.

Complainants and each of them except to the failure or refusal of Special Master appointed herein to grant complainant's requested conclusion of law No. 23, appearing on pages 109 and 110 of complainant's requested findings of fact, conclusions of law, and recommendations for a decree, which reads as follows, to-wit:

> "(23) That all prior Permits issued by the Secretary of War do not purport to authorize the abstraction of the waters of the Great Lakes-St. Lawrence system, and do not undertake to authorize the invasion or injury of the property and rights of the peoples of the complainant states or the proprietary or quasi-sovereign rights of said complainant states."

XVII.

Complainants and each of them except to the failure or refusal of Special Master appointed herein to grant complainant's requested conclusion of law No. 24, appearing on page 110 of complainant's requested findings of fact, conclusions of law and recommendations for a decree, which reads as follows, to-wit:

> "(24) That neither the Congress of the United States nor the Secretary of War by means of the Permit of March 3, 1925, or any prior Permit, has appropriated or attempted to appropriate any of the waters of the Great Lakes-St. Lawrence system for navigation purposes in the Des Plaines, Illinois, or Lower Mississippi Rivers."

XVIII.

Complainants and each of them except to the failure or refusal of Special Master appointed herein to grant complainant's requested conclusion of law No. 25, appearing on page 110 of complainant's requested findings of fact,

conclusions of law, and recommendations for a decree, which reads as follows, to-wit:

"(25) That the State of Illinois and the Sanitary District of Chicago, by their acts of which complaint is made, have unlawfully interfered and are unlawfully interfering with and placing a burden upon the freedom of interstate commerce to the injury of the complainant states and the peoples of said states."

XIX.

Complainants and each of them except to the failure or refusal of Special Master appointed herein to grant complainant's requested conclusion of law No. 26, appearing on page 110 of complainant's requested findings of fact, conclusions of law, and recommendations for a decree, which reads as follows, to-wit:

"(26) That the States of Minnesota, Wisconsin, Ohio and Pennsylvania, in their respective proprietary capacities and in their governmental capacities representing the people who own lands bordering on the Great Lakes and the connecting waterways between the same within said states, have riparian rights in and upon said waters, which riparian rights are property; which property is being taken and will continue to be taken without due process of law, and without just compensation, in violation of the Fifth and Fourteenth Amendments to the Constitution of the United States, by the lowering of said waters, by reason of the permanent abstraction and diversion of the waters of the Great Lakes-St. Lawrence watershed by the defendants, Sanitary District of Chicago and State of Illinois, through the Chicago Drainage Canal."

XX.

Complainants and each of them except to the failure or refusal of Special Master appointed herein to grant com-

plainant's requested conclusion of law No. 27, appearing page 111 of complainant's requested findings of fact, co clusions of law, and recommendations for a decree, whi reads as follows, to-wit:

"(27) Neither the Congress of the United Stat in the exercise of its power to regulate commerce, n any governmental official of the United States, has ar power or authority to authorize or consent to a lowe ing of the waters of the Great Lakes, to the injury, i vasion or destruction of complainants' riparian right in or upon said waters."

XXI.

Complainants and each of them except to the failure o refusal of Special Master appointed herein to grant com plainant's requested conclusion of law No. 32, appearing o pages 111 and 112 of complainant's requested findings o fact, conclusions of law, and recommendations for a decree which reads as follows, to-wit:

"(32) That the complainant states are entitled to a decree dismissing the petitions of the intervening states and enjoining the State of Illinois and the Sanitary District of Chicago, their employees, agents, attorneys and servants, from abstracting any of the waters of the Great Lakes-St. Lawrence system through the Chicago Drainage Canal and its auxiliary channels, or through or by means of any other method, device or agency."

XXII.

Complainants and each of them except to the refusal of the Special Master appointed herein to grant or make recommendations for a decree requested by the complainants, appearing on pages 112 and 113 of complainant's

requested findings of fact, conclusions of law, and recommendations for a decree, which reads as follows, to-wit:

"(1) Complainants request the Special Master to recommend a decree in this case in substance as follows:

(Caption omitted)

"This cause coming on to be heard upon the report of the Special Master, Charles Evans Hughes, Esq., to whom it was referred to take the evidence and to report the same to the Court with his findings of fact, conclusions of law and recommendations for a decree, and also upon the exceptions taken to said report on the part of the plaintiffs, defendants and intervening defendants, and said cause having been argued by counsel for the respective parties and due deliberation had thereon, it is:

"Ordered, adjudged and decreed as follows:

"(1) That each and all of the exceptions taken to said Special Master's report by either or any of the parties be overruled.

"(2) That the respective petitions of the intervening states of Missouri, Tennessee, Kentucky, Arkansas, Mississippi and Louisiana and each of them are dismissed.

"(3) That the defendants, State of Illinois and the Sanitary District of Chicago, their employees, servants, attorneys and agents be and they hereby are ordered to cease, desist and refrain from abstracting any of the waters of the Great Lakes-St. Lawrence system or watershed through the Chicago Drainage Canal and its auxiliary cha nels, or through or by means of any other method, device or agency.

"(4) That the complainants have and recover from the Sanitary District of Chicago and the State of Illinois their costs and disbursements herein to be taxed and noted at the foot of this decree.

By the Court,

....,

Clerk of the Supreme Court of the United States."

Respectfully submitted,

JOHN W. REYNOLDS,

Attorney General of Wisconsin.

HERMAN L. EKERN,

Special Assistant Attorney General of Wisconsin.

R. T. JACKSON,

Special Assistant Attorney General of Wisconsin.

HERBERT H. NAUJOKS,

Assistant Attorney General of Wisconsin.

CLIFFORD L. HILTON,

Attorney General of Minnesota.

EDWARD C. TURNER,

Attorney General of Ohio.

NEWTON D. BAKER,

Special Assistant Attorney General of Ohio.

T. J. BALDRIDGE,

Attorney General of Pennsylvania.

APPENDICES OF COMPLAINANTS' EXCEPTIONS TO THE REPORT OF THE SPECIAL MASTER FILED HEREIN.

While complainants have endeavored in these appendices, for the convenience of the Court, to set out the respective portions of the transcript, record, and exhibits in this case which are deemed material for the consideration of the complainants' exceptions filed herein, complainants request that such appendices shall not be construed as barring reference to and consideration of any other evidence appearing in the record which may be referred to in complainants' brief in support of these exceptions.

Appendices have been numbered "A" to "S," inclusive.

APPENDIX "A."

"The Witness. In the construction of that drainage canal, the Des Plaines River was straightened for many miles above Lockport, and its channel was improved from Lockport on down through Joliet, so that it would be capable of taking the combined floods of the Des Plaines River watershed and the Chicago River watershed, or a total of about 250,000 second-feet. This channel was built between 1892 and 1900, it was started September 3, 1892, and water was let into it January 2, 1900."

Ramey, Transcript Vol. 14(2) p. 3317.

Q. Will you state your education?

A. I graduated from Carlisle, Kentucky, High School in 1901. I attended Kentucky State College from 1901 to 1903. I attended the University of Michigan from 1903 to 1907, specializing in hydraulic engineering and graduated in 1907 with a degree of Bachelor of Science in Civil Engineering. Ten years later, in 1917, I was given the degree of Civil Engineer by the University of Michigan.

Q. What has been your experience in engineering?

A. Well, I was an instructor in surveying in the University of Michigan in 1906. Since 1907 I have been with the Sanitary District as rodman, computer, junior engineer resident engineer, assistant engineer, senior assistant engineer, and since 1922 as assistant chief engineer.

Ramey, Transcript 3283.

"In case a channel is constructed in the Des Plaines River as contemplated in this section it shall be carried down the slope between Lockport and Joliet to the pool commonly known as the upper basin, of sufficient width and depth to carry off the water the channel shall bring down from above. The district constructing a channel to carry water from Lake Michigan of any amount authorized by this act may correct, modify and remove obstructions in the Des Plaines and Illinois Rivers wherever it shall be necessary so to do to prevent overflow or damage along said river."

Exhibit 10 Vol. 2 pp. 223, 224.
Illinois Act of May 29, 1889.

APPENDIX "B."

"Mr. Adcock. I ask to have marked as Defendants' Exhibit No. 1110 the paper which I have in my hand bearing the legend at the top, "Tables showing costs of works in dilution project of the Sanitary District of Chicago to December 31, 1926."

Mr. Jackson. Is that marked for identification, Mr. Adcock?

Mr. Adcock. No.

Mr. Jackson. I wish you would do that.

Mr. Adcock. Mark it for identification.

(The paper referred to is marked, "Defendants' Exhibit for identification No. 1110.")

By Mr. Adcock:

Q. Mr. Ramey, I show you the paper which has been marked Defendants' Exhibit for identification No. 1110. Will you state what you know about that paper and how it was prepared?

A. That paper shows the cost of works in the dilution project of the Sanitary District up to December 31, 1926. The figures were taken from the books of the Sanitary District by an engineering accountant working under my direction.

Q. And the different works that you have described are indicated there and the amount that the construction cost? Is that correct?

A. Yes; the various channels or sewers in the dilution project are indicated by name, the time when they were built is indicated and the cost is shown.

Mr. Jackson. We object to Exhibit No. 1110.

Mr. Adcock. I have not offered it yet.

Mr. Jackson. Pardon me. I thought you had.

By Mr. Adcock:

Q. Was the person who prepared the figures in this exhibit in the employ of the Engineering Department of the District?

A. He is.

Q. And under your authority?

A. He is.

Q. And he has been in that employ for how long?

A. Oh, he has been in the employ for ten or fifteen years.

Q. And you are familiar with the accuracy of his work, are you?

A. He is a very competent accountant.

Mr. Adcock: I will offer the exhibit in evidence.

Mr. Jackson. May I ask a question, please?

By Mr. Jackson:

Q. Mr. Ramey, these figures appearing upon Defendants' Exhibit for identification No. 1110 purport to be taken from the books and records of the Sanitary District of Chicago? Is that correct?

A. Well, there is one item in there for sewers built by the City of Chicago $6,706,804.37.

Q. Does that purport to be taken from the books of the City of Chicago?

A. That is a figure which was furnished to the Sanitary District by the Engineering Department of the City of Chicago. That is the lake front intersecting sewers and pumping stations which were built by the City of Chicago and turned over to the Sanitary District to operate.

Q. It was not sold to the Sanitary District.

A. No.

Q. Is it still owned by the City of Chicago?

A. I do not know who owns the stations.

Q. That figure is one that was given you by the City of Chicago, or some official of it, but has not been checked by you or your accountant? Is that correct?

A. No; I do not believe my accountant checked the details of that figure.

Q. The balance of the figures came from the books of the Sanitary District of Chicago?

A. They did.

Q. Mr. Ramey, there are a good many errors and inaccuracies in the books and financial records of the Sanitary District of Chicago, are there not?

A. Not that I know of.

Q. Was there not a recent audit made of the books of that municipality or organization?

A. There was.

Q. And did not that audit to your knowledge disclose a great many irregularities in the expense accounts and charges on the various projects of the Sanitary District of Chicago?

A. Not to my knowledge.

Q. Did you ever examine the report?

A. No; I have not seen the report.

Q. Have you a copy of the report in your office?

A. No.

Q. Are you willing to swear that you believe that all of the books and accounts of the finance of the Sanitary District of Chicago are true and correct and accurate?

Mr. Adcock. I do not think that is a fair question. In books kept in the regular course of business there may be errors. I do not think it is a fair question to ask this witness.

The Special Master. The proof is not technical, you understand. I suppose the question is directed to the degree of credit which may be given to it, and the witness is asked as to whether he believes it to be correct, or the underlying data to be correct.

A. I believe the figures shown on this tabulation and the distribution of these various figures against the various construction projects shown on this table are correct.

By Mr. Jackson:

Q. Did you personally check the books on that?

A. I have not personally checked the books on that as to figures since about 1920, but prior to that time I did check them.

Q. Did it not come to your attention that the recent audit of the books of the Sanitary District of Chicago disclosed large sums charged to plants that did not exist?

A. No.

Q. That did not come to your attention?

A. No.

Q. Did it come to your attention that there were charged in the various accounts for works and projects employment of large numbers of men prior to elections who were immediately released?

A. No.

Q. None of those things came to your attention?

A. No.

Q. If those things had come to your attention, would you be willing to swear to the whole faith and credit of these books?

A. I do not pretend to know about the general books of the Sanitary District. These figures on this sheet are taken from the accounts of the Engineering Department, and I do know that the charges on these books are properly distributed.

Q. But you do not know whether they are proper in amount?

A. Yes; I do know that the moneys represented by this table were expended on the items indicated in this table.

Q. How do you know that, Mr. Ramey?

A. Because I know that this man working under my direction has checked the vouchers in the Engineering Department and obtained these figures from those vouchers.

Mr. Jackson. We object to the admission of this exhibit, Defendants' Exhibit No. 1110 for identification.

In the first place, we think it is entirely irrelevant and immaterial what expenditures may have been made upon sewer systems in the city of Chicago, and we object to the competency of this table as we do not think it is the best evidence, and it is possible that if the Master deems it relevant, if the defendants were willing to permit our auditor to examine the books of the defendant corporation and ascertain the correctness of these figures, we would not raise any point on that part of it.

Mr. Adcock. I might like to ask the witness just one question as to the intersecting sewer system.

By Mr. Adcock:

Q. The interceptors which you referred on the North Side and on the South Side of the city, and the pumping

stations and conduits connected with those interceptors and pumping stations, were originally constructed by the city of Chicago?

A. They were originally constructed by the city of Chicago, and were turned over to the Sanitary District in 1910 to be operated. Since that time they have been maintained and operated by the Sanitary District of Chicago.

Q. Do you know whether there is carried on the books of the Sanitary District, as part of the cost of that diversion project, an item representing the construction cost of these intercepting sewers, pumping stations and conduits?

A. On the books of the Engineering Department is carried an item for certain expenditures that the Sanitary District made. For instance, the 39th street pumping station was built by the city of Chicago and the Sanitary District; the flushing pumps for that system were built by the Sanitary District; the sewage pumps were put in by the city of Chicago; the superstructure and boiler plants were paid for partly by the Sanitary District and partly by the city of Chicago. I think the Sanitary District paid 40 percent of that. All betterments made on these stations since 1910 have been paid for by the Sanitary District.

Q. Is there any item that appears on that table that represents money expended by the city of Chicago itself?

A. Yes, sir. The table indicates the lake front intercepting sewer and the sewage pumping station, the two items, by the city of Chicago, $6,706,000, and by the Sanitary District, $1,342,000. It was an oversight when I mentioned that we got all those figures from the books of the Engineering Department. The table on its face shows that fact.

By Mr. Jackson:

Q. General Taylor, retired Chief of Engineers, investigated some of these works this summer, did he not, to your knowledge?

A. Yes, sir.

Q. Among other things, he reported that there appeared on the Sanitary District's books that a certain works had cost twice as much as had been paid by the

Government for exactly the same kind of work performed at the same time in the city of Chicago or vicinity.

A. There was some statement in General Taylor's report about the high cost of dredging in the Little Calumet River.

Q. And that was twice or more what the Government was paying at the same time for dredging in the same river?

A. Yes, sir; but in a different part of that same river and under entirely different conditions.

By Mr. Adcock:

Q. Do you know how the contracts for all this construction work were let by the Sanitary District of Chicago?

A. The contracts were advertised, bids were taken, and in every case, with very few exceptions, the work is awarded to the lowest bidder.

The Special Master. It seems to me you are putting a good deal of time on a matter which hardly requires quite as much consideration as you seem to be inclined to give it. If the exact amounts expended by the Sanitary District were in question here, as if somebody were trying to recover a sum of money on the ground that these outlays were made, of course, this proof would be entirely incompetent for such a purpose, and no finding of an exact amount could be predicated upon such evidence as this, if objected to, because, of course, there would be hosts of items as to which proof would be required if technical rules were applied.

This, however, is not a case in which the exact amount of money, as I understand it, expended by the Sanitary District must be determined. I suppose no one questions that the Sanitary District has expended a large amount of money. Whether it has expended so many millions as one might say, or so many millions as another might say, is entirely immaterial and will not control any disposition of this case, as you readily will see. Of course, I suppose the idea is the equities which may be supposed to adhere in any large expenditure. A great sanitary system

cannot be constructed without very large expenditures, and I do not see that the exact amount is of any great importance.

I shall receive this exhibit upon the statement of the witness that this appears on the books of the Engineering Department, so far as it does appear, or has been received from the city of Chicago, so far as the items relating to expenditures have been furnished by the city. I shall not receive it as proof that that particular sum has actually been expended. Proceed with the case.

Mr. Adcock. I then offer in evidence this Defendants' Exhibit for identification No. 1110.

(Said document was thereupon received in evidence, marked "Defendants' Exhibit No. 1110," and is as follows:)

TABLE SHOWING COSTS OF WORKS IN DILUTION PROJECT OF THE SANITARY DISTRICT OF CHICAGO

TO DECEMBER 31ST, 1926.

Works	*Built*	*Cost*
Main Channel, Controlling Works, Des Plaines River Diversion, Des Plaines River Improvement	1892-1900	$34,690,901.07
Main Channel Extension	1904-1907	3,992,755.74
Lake Front Intercepting Sewers and sewage Pumping Stations		
By City of Chicago	1898-1910	6,706,804.37
By Sanitary District		1,342,248.66
North Shore Channel	1907-1911	4,192,659.95
North Shore Sewer	1913-1916	691,846.38*
Evanston Intercepting Sewer and Pump. Sta.	1916-1920	1,963,343.45*
Calumet Sag Channel	1911-1922	14,159,558.75
Calumet Sewers and Pumping stations	1915-1924	11,960,313.17*
Calumet River Improvement	1915-Date	666,905.19
Chicago River Improvement	1897-1920	13,059,581.16
Auxiliary Sewers		3,195,049.50
General Engineering		1,683,172.13
		$98,305,139.52
Less Items marked * used in Sewage Treatment Project		14,615,503.00
Bare Construction Cost		$83,689,636.52
Administration, Legal, Clerical, etc. Expenses		6,788,564.15
Interest on Bonds for Construction		18,543,412.54
Total		$109,021,613.21

Transcript Vol. 14, pp. 3335-3348.

"Mr. Adcock. I will ask the reporter to mark this document, entitled, 'Sanitary District of Chicago, Cost of Lockport Power Plant and Distribution System,' as Defendants' Exhibit No. 1115, and offer the same in evidence.

Mr. Jackson. We object to Exhibit 1115, as to its competency and relevancy, if the amount of the figures are material. If it is merely to show they have expended something, which is apparent, we do not care, but we would not want the accuracy of those figures to be accepted.

The Special Master. It will be received in the same way as the other figures to which objection was taken, as showing the amounts which the books show to have been expended, but not as evidence that those amounts were actually expended.

Mr. Adcock. That is, to the exact dollar?

The Special Master. Yes. Of course, as counsel says, the fact that amounts have been expended is shown by the construction of the power house, but if you start in to prove with all the regulations governing that all of these expenditures, just what has been expended, I think you will have to get another Master.

Mr. Adcock. Of course, we do not want to do that.

The Special Master. Of course, I will add to what I just said, that if it were germane to the controversy here in the sense that the exact figures had to be proved, the Master would see it through.

Mr. Adcock. Although it takes all summer.

The Special Master. Yes."

Transcript Vol. 14, pp. 3386-3387.

"Q. Are not contracts let upon a certain price per cubic yard of concrete in the City of Chicago?

A. I think the Sanitary District sewers have been let on a per foot basis, the ones that I know anything about. I have had a number of canvasses of bids in which the bids were received at so many dollars per foot, including concrete, excavation, plant, overhead; the entire cost.

Q. Did you know the bid prices on actual contracts let?

A. Yes.

Q. That is, where they were let to the lowest bidder?
A. Yes.

Q. That is for the same kind of sewer, practically?
A. Yes.

Q. Substantially the same size of sewer, and where there was excavation in tunnel? Is that correct?
A. Yes.

Q. You did not use those?
A. No, for the reason that the ones that I saw as being recent were very exorbitant. The price of those tunnels in clay built by the Sanitary District 20 feet to 30 feet under the ground surface was greater than the cost of rock tunnels of the same type built by the city of Chicago 150 to 160 feet below ground. I, therefore, did not believe, and do not now believe, that those tunnel contracts for sewers which I saw were of much value in the investigation with which we were intrusted, namely, to determine the fair and reasonable cost of the work.

Q. How do you know the cost of the rock tunnels that you say were built by the city?

A. I got them from the city's records."

Transcript of Testimony, Mr. Howson, Pages 9438 to 9440.

"Q. In response to questions from counsel on cross examination with reference to your reasons for not using the contracts let and costs of work done by the Sanitary District as the basis of estimate for the reasonable cost of construction of the necessary works provided in the sewage program, you pointed out certain facts with reference to tunnel construction as a basis for not using such contracts. Were there any other factors involved in the contracts let or work done by the Sanitary District studied by you which led you to consider such contracts and works as unreliable as a basis of estimate of the reasonable cost of the sewage treatment works?

A. Yes. Referring to Table No. 35, page 236, in our report to the District Engineer, on which I was cross examined yesterday, there are four plants to which my cross examination was directed.

At the bottom of this same table is a comparison of these four plants costs with the Chicago Calumet plant. This comparison shows that the weighted averages of the plants in Cleveland, Rochester, Philadelphia and Albany were $5 per capita, whereas the Calumet plant in Chicago was $26.40 per capita, and compared with the price per million gallons capacity basis the weighted averages of these four plants are shown as $30,750, as compared with $86,000 for Chicago.

This range being so great, we asked the Sanitary District for the bids on which this work was done, and that is discussed in this report which we made to the District Engineer.

In this report the tabulation of bids of the Calumet plant showed that the contract for concrete for the tanks, 28,000 cubic yards, was let at a price of $64 per cubic yard, exclusive of reinforcing steel.

In all of the work covered by our experience we had never let concrete work of that or a similar type at a price to exceed $30 per cubic yard, approximately half of that figure.

Reading again from the report:

'The steel, 3,000,000 pounds, was let at a unit price of 23 cents per pound.'

We have let large amounts of work and have never yet paid over 6 cents a pound for reinforcing steel. I never have personally known of a job in which reinforcing steel cost to exceed 6 cents per pound.

This price for 3,000,000 pounds was 23¢ per pound.

Reading again from page 235 of our report:

'The concrete, complete, therefore, was let at a unit price exceeding $85 per cubic yard. The work included 30 tanks, permitting multiple use of forms and plants.'

The excavation on this job was $6.90 per cubic yard, as compared with a maximum of about $2 per cubic yard on any work under our direction. Accordingly I could not adopt these unit prices or the table as a measure of the cost of the work which we were required to estimate. and so state in this report to the Government. The other major type of plant construction was of activated sludge. The comparison on activated sludge plant costs to which my attention was directed on cross-examination is Table 42, page 251 of our report to the District Engineer, in which it is shown that the average cost of the four plants, exclusive of the Chicago plant, on a basis of per capita is $7.45. The Milwaukee plant was $13.78, that being the most expensive. Also, that the weighted average of the complete plant was $10.45 per capita. On the Des Plaines plant, as shown at the foot of this table, it was $30.65. The comparison on the per million gallons daily capacity basis for the complete plant was $74,305, as compared to the Des Plaines plant, $306,500, about four times as much. The Des Plaines plant, handling about five million gallons per day, cost about one-fifth as much as the Milwaukee plant, to handle 85,000,000 gallons per day. That being the case, as stated in the report, our costs are based pretty largely on a study of other plants rather than upon the data on possible costs of the Chicago Sanitary District."

Transcript of Testimony, Mr. Howson, Pages 9546 to 9550.

APPENDIX "C."

"The Sanitary District of Chicago,
Chicago, June 16, 1896.

Dear Sir:—

The work of the Sanitary District of Chicago has progressed so far that it is now necessary for us to enter upon that which must be done in the Chicago River to make available the artificial channel which we have under construction from Robey Street, Chicago, to Lockport in Will County, twenty-eight miles distant.

"Our connection with Lake Michigan must be through the Chicago River with the West Fork of the South Branch of which we make a junction at Robey Street. We send herewith a map showing in a general way our plans for improving the Chicago River by widening and deepening at the points indicated thereon by red hatchings and by figures which refer to explanations given in the legend on the map. It is desired to so correct and regularize the cross section of the river as to secure a flowage capacity of 300,000 cubic feet per minute with a velocity of one and one quarter miles per hour. The cross section necessary to accomplish this can be obtained throughout the greater part of the distance between Monroe Street and Robey Street by dredging the river to a depth of 20 feet at mid-stream with 12 feet at dock lines, and a uniform slope away from docks of one foot in five so that the full depth would be reached forty feet from the dock lines; but there are places so narrow that this cross-section can only be obtained by widening the River; and again the depth to be obtained in the vicinity of Van Buren Street is limited by the height of the crown of the Tunnel. To obviate this difficulty it is proposed to secure the requisite cross section by constructing a by-pass to the West of the bridge at Adams, Jackson, and Van Buren Streets as indicated. We ask your permission to proceed with the work upon the lines indicated and so far as is consistent with propriety and cooperation of the United States Engineer Department.

"Awaiting your favorable reply and holding ourselves ready to respond to any call from you for fuller information as to our plans, I am

"Yours respectfully,

B. A. ECKHART,

President.

Application of Sanitary District of Chicago.
Doc. 1, Ex. 12, Tr. 228-230.

Subject: Application of Trustees Sanitary District, Chicago.

UNITED STATES ENGINEER OFFICE,

1637 Indiana Avenue, P. O. Drawer 132.

Chicago and Calumet Harbors
Illinois and Calumet Rivers
Illinois and Mississippi Canal.

Major W. L. Marshall,
Corps of Engineers, U. S. A. Chicago, Ill.,

June 24, 1896.

Brig. Gen. Wm. P. Craighill,
Chief of Engineers, U. S. A.
Washington, D. C.

General:

"I have the honor to report upon the application of Mr. B. A. Eckhart, President Board of Trustees Sanitary District of Chicago, for the authority of the Secretary of War to make certain changes in the capacity of the channel of Chicago River for drainage purposes.

"As far as the work itself is concerned there can be no objection to it, as in every case the navigable channel of Chicago River will be improved, and at this stage I am unable to do otherwise than to recommend the granting of the authority sought.

"The question that must come up later for the action of the War Department, to-wit. Whether the improved channel of Chicago River will be sufficient to carry 300,-

000 cubic feet of water per minute without lessening or destroying the navigability of Chicago River, or whether the City of Chicago will be allowed by the United States and Great Britain to take any water at all from the Great Lakes, with the inevitable result of lowering their levels, is not now under investigation, and is one that will not probably be settled or decided by executive officers. It is, or may rather be considered an international question.

"For the present, I have to respectfully recommend that the necessary authority be granted as requested for the *general* plan, under the following conditions:—

"(1.) That while the general plan is approved, the Sanitary District of Chicago, must furnish plans in triplicate on an enlarged scale showing each proposed new bridge, each bypass, and each new dock or wharf, proposed to be built, in order that the Secretary of War, under the law may act intelligently in each case.

"(2.) That this authority shall not be interpreted as approval of the plans of the Sanitary District of Chicago to introduce a current into Chicago River. This latter proposition must be hereafter submitted for consideration.

"(3) That it will not cover obstructions to navigation, by reason of this work while in progress, or when completed.

"(4.) That the United States shall not be put to expense by reason of this work.

"(5.) That this authority will expire by limitation in two years from date unless extended.

"Very respectfully,
Your obedient servant,

(Signed) W. L. MARSHALL,
Major, Corps of Engineers.

Report of U. S. District Engineer,
Doc. 2, Ex. 12, Tr. 230-232.

4th indorsement.

OFFICE CHIEF OF ENGINEERS
U. S. ARMY.

June 29, 1896.

Respectfully returned to the Secretary of War. The Board of Trustees Sanitary District of Chicago requests permission to make certain changes in the capacity of the channel of Chicago River for drainage purposes. The work proposed is shown on the accompanying drawing.

"The matter has been under consideration by Maj. W. L. Marshall, Corps of Engineers, who recommends that the permission asked be granted subject to the following conditions.

"1. That while the general plan is approved, the Sanitary District of Chicago, must furnish plans in triplicate on an enlarged scale showing each proposed new bridge, each by-pass, and each new dock or wharf proposed to be built, in order that the Secretary of War may act intelligently in each case.

"2. That this authority shall not be interpreted as approval of the plans of the Sanitary District of Chicago to introduce a current into Chicago River. This latter proposition must be hereafter submitted for consideration.

"3. That it will not cover obstructions to navigation by reason of this work while in progress, or when completed.

"4. That the United States shall not be put to expense by reason of this work.

"5. That this authority will expire by limitation in two years from date unless extended.

"I concur in this recommendation.

WILLIAM P. CRAIGHILL,
Brig. Gen., Chief of Engineers.
July 6, 1896—Chief Clerk.
Recd. Office, Chief of Engrs."

15715

Incls. 1 & 2 accomp'g

Recommendation of Chief of Engineers, Doc. 3, Ex. 12.

Transcript Vol. 2 pp. 229-235.

"July 16, 1901,

"The river is being dredged to 26 feet in the narrowest parts, bridges are being re-constructed as rapidly as possible, and condemnation proceedings begun to widen the South Branch to 200 feet."

Excerpt, Report U. S. District Engineer, Doc. 14, Ex. 12.

Transcript Vol. 2 p. 271.

THE SANITARY DISTRICT OF CHICAGO

Oct. 16, 1901

"Hon. Elihu Root,
Secretary of War of the United States
Washington, D. C.

"Dear Sir:

The Undersigned respectfully petition you as Secretary of War to give us permission for an increased flow in the Chicago River, over the 200,000 cubic feet a minute, now in force by your order of July 23, 1901. We, the petitioners, inasmuch as a number of very material improvements have been made in the Chicago River, such as removing center pier bridges, widening the river at many points, and also deepening the same, thereby allowing a much greater flow without any perceptible increase in velocity of the current, believe that we are fully justified in petitioning you to grant to the Board of Trustees of the Sanitary District of Chicago permission to increase the flow from 200,000 to 250,000 cubic feet per minute, during that period of the day allowing a flow of 200,000 cubic feet per minute.

Below we enumerate the following improvements.

The old Randolph Street center pier bridge is now removed and all obstructions which hindered navigation will be out of the way but a few weeks, and a bascule type, with a 140 foot opening, will be erected, similar to that on Taylor Street.

The old Harrison Street center pier bridge is removed, and a new bascule type bridge, with 140 foot opening, with by-passes on each side, is being erected instead.

At Taylor Street the new bascule bridge is in operation, which has a clear opening of 120 feet.

The new bascule bridge of the Chicago Terminal Transfer Railway Company is about ready to be operated, and the old center pier bridge will immediately be removed.

Just north of 12th street the river has been widened, by cutting away of the 12 foot corner, which projected into the river at this place.

From 12th street to Stewart Avenue, the river has been deepened below the hydraulic grade line to a depth of twenty-six feet. Also a strip from 400 feet above 18th Street to Stewart Avenue was made 200 feet wide.

At Canal Street, the old jack-knife bridge with projecting piers has been removed, and a new bridge of the bascule type—the same as at State, Randolph and Harrison Streets—is in process of erection.

The river from Canal Street to 22d Street has been widened in the east side about 30 feet.

The deepening of the river to 26 feet, from 22nd street to about 500 feet west of Main Street, is almost completed. Along this stretch the river has been widened for a distance of about 300 feet at Collision Bend.

From 150 feet east of Halsted Street to 150 feet west of Halsted Street, the river was deepened to 28 feet.

From 900 feet east of Main Street to 300 feet west of Main Street, the river has been widened to 200 feet.

The old center pier bridge and pier at Main Street have been removed, and a new bridge of the same type as at Taylor Street is being erected.

The old center pier bridge and center pier at Ashland Avenue have been removed, and a new bridge of the Page bascule type, with a clear opening of approximately 140 feet with a 40 foot by-pass on each side of the river, is in process of erection.

"The removal of the State Street center pier bridge has been contracted for, and a bridge of bascule type with 140 feet clear opening, and by-passed on each side is to be erected immediately.

In view of the foregoing improvements that are being carried out now, and many others which will follow as quickly as said work can be performed, we feel justified in asking you to permit the Sanitary District of Chicago to increase the flow as hereinbefore suggested."

Doc. 16, Ex. 12, Transcript Vol. 2 pp. 275-277.
Application of Sanitary District of Chicago.

Chicago, Illinois, November 5, 1901.

"The Board now ask that they be permitted to discharge 250,000 cubic feet per minute instead of the 200,000 now authorized between midnight and 4 P. M. They say nothing about the hours from 4 P. M. to midnight, and it may be assumed that they would expect to continue the discharge 300,000 cubic feet now authorized for those hours. They give as a ground for this request the improvements which they have made in the Chicago River, which, they claim, will permit a much greater flow without any perceptible increase of velocity, and they present a list of obstructive bridge piers removed and of places where the river has been widened or deepened by excavation.

The enlargement of the Chicago River has been begun by the Sanitary District under a systematic plan and able management. It has made good progress as shown by the list of improvements; but it is very far from complete. Eight bridges are mentioned, of which one has but just been put out of contract; there are 20 more bridges to be removed. There are three tunnels under the river, which are among the worst obstructions of all; no steps for their removal have been taken. A large amount of widening has to be done. The project contemplates an expenditure of about $9,024,000, and does not include the removal of the tunnels. Of this sum about $1,000,000 has been expended. Some work was done before the adoption of the present project. Roughly speaking, then, the improvement is about one-ninth completed. Relief has been given to navigation at detached points, but the ground taken that the improvements have been extensive enough to accommodate a much

greater flow without detriment to navigation is untenable. If a flow of 250,000 cubic feet per minute would have been a serious injury to navigation last year, it would be so still. Persons representing the navigation interests are decidedly of opinion that it would have been so then and would be so now. Unfortunately this is only an opinion and must remain so until it can be tested by experiment.

The Board of Trustees say nothing about the sanitary question, which is the essential question after all. If it can be shown that the discharge of sewage with the present degree of dilution into the Illinois River is endangering the lives of the people on its banks, either the discharge must be stopped entirely or the dilution must be increased sufficiently to make it harmless. I can see no middle ground."

Doc. 17, Ex. 12, Transcript Vol. 2 pp. 281-283.
(Report of U. S. District Engineer on foregoing application)

"Complainant's Exhibit No. 13.

Mr. Jackson. The next offer for the record at this point is Complainant's Exhibit No. 13, now reading as follows:

'In 1902 Col. O. H. Ernst, United States Engineer at Chicago, made a report to the Chief of Engineers, Report of Chief Engineers, 1902. App. K. K., p. 2097.

'Since the flow of the Chicago River has been reversed through the South Branch by the discharge into the sanitary canal the slope has also been reversed from the lake upstream and the depth correspondingly reduced. This loss in navigable depth will be more than restored in the main stream and in the South Branch by the excavations of the sanitary district, which, in order to facilitate the flow of the large volume of water required for the dilution of the sewage discharged into the drainage canal, has undertaken to enlarge those portions of the Chicago River to a width of 200 feet and central depth of 26 feet. These dimensions have no relation to the draft of vessels using the river, and if maintained as they should be for drainage

purposes will furnish a navigable depth in excess of the requirements. The south fork of the South Branch and the North Fork, however, do not share in these benefits. In the South Fork particularly the dimensions of channel obtained by the operations of the Government were seriously impaired by the change of slope. The sanitary district has undertaken to restore these dimensions, and will no doubt do so, though it has been prevented from fully accomplishing the work by some difficult rock excavation. But it has not undertaken as yet to maintain them.

'The Chicago River is the main sewer of Chicago, and as such is subject to deteriorating influences as a navigable channel from which there is no escape. The city ordinances against dumping solid matter into it are ample, and, I think, generally well observed. But a very large amount of solid matter must of necessity go into it with a perfectly legitimate use of it as a sewer. Periodical dredging will be necessary to maintain it as a navigable channel and, eventually, to maintain it even as a sewer. That work would seem to be as much the duty of the city as the maintenance of any other part of its sewer system. So far as the South Branch is concerned, the question has been solved by the necessities of the drainage canal, as already mentioned, but the sanitary district has not accepted responsibility for maintaining the other branches. Whether that organization or some other representing the people of Chicago should do the work is for them to decide, but it seems to me clear that the United States should not be called upon to do it. Accordingly, no estimate for maintaining the channel excavated under the project of 1896 is submitted.' ''

Ex. 13, Transcript Vol. 2 pp. 292-293.

"That the sanitary district had recognized the difficulty of flowing enough water through the Chicago River was evidenced some years before the Secretary of War had indicated his disapproval of producing obstructive currents. On April 21, 1891, the trustees proposed a resolution providing that they 'forthwith enter upon, use, widen, deepen, and improve the Chicago River from its mouth at

Lake Michigan * * * so as to make the same a proper and sufficient supply channel * * *.'

A start was made on this work in 1897 for certain improvements between Harrison and Quincy Streets and a permit for this short piece of work was issued by the Secretary of War on November 16, 1897. However, it was not until April 26, 1900 that the sanitary district made application to the Secretary of War for a permit to widen, deepen, and straighten the whole of South Branch of the Chicago River so as to provide the discharge capacity desired without introducing obstructive currents. A permit was issued by the Secretary of War on July 11, 1900 (Appendix 14), allowing the sanitary district to proceed with this work covering that section of the river between Twelfth Street and Ashland Avenue.

On January 17, 1902 a permit was issued for the rest of the work on the South Branch from Twelfth Street to Lake Street (Appendix 15). Work under these permits was under way for a period of years. Efforts were directed toward obtaining a channel of a minimum width of 200 feet with a depth of 26 feet for the middle 100 feet, shoaling to 16 feet at the dock faces. Up to December 31, 1917, a total of over $12,000,000 was expended by the sanitary district for right of way, dredging, and construction of bridges. At the present time the desired channel improvements have been finished throughout the entire stretch from Lake Street to Robey Street. There are a few bridges yet to be replaced.

It can not be said that all of the results expected from improving the channel have been obtained. Through this portion of the channel the discharge is fairly constant, averaging in the neighborhood of 8000 cubic feet per second. The effect of withdrawing maximum amounts at the power house at Lockport is equalized by the storage capacity of the channel between Lockport and Lake Michigan, so that the variations which occur near the source of supply result largely from fluctuations in the level of the lake. Deliberate efforts on the part of the Sanitary District of Chicago to establish and maintain a uniform flow of 10,000 cubic feet per second through the Chicago River have been

unsuccessful. While these attempts were experimental, they indicate that the stream is still too crooked and narrow to permit that volume of discharge under ordinary conditions of head.

The east and west arms of the South Fork of the South Branch were dredged in 1913 by the sanitary district for the stockyard interests to 20 feet in the former arm and to 18 feet in the latter as far as Ashland Avenue, and to 13.5 feet above that street. The portion above Ashland Avenue has since been filled. This deepening was for the purpose of providing an adequate discharge channel for the sewage from Packingtown.

The sanitary district straightened the channel of the North Branch for 2 miles northward from Belmont Avenue, providing 12 feet depth and 90 feet width to the north side of Lawrence Avenue. In 1917 they dredged to Roscoe Street from Belmont Avenue to a depth of 15 feet for a width of 20 feet in mid-channel; also a turning basin along the west dock north of Roscoe Street, about 500 feet long, 50 feet wide, and 15 feet deep. These improvements facilitated the discharge of water through the North Branch by way of the North Shore Channel."

Exhibit 1 pp. 33-35.

Report of Major Putnam, U. S. District Engineer, Nov. 1923.

"EFFECTS OF CHANGES.

By comparing the projects and work of the Federal Government and the Sanitary District of Chicago it will be seen that while the former agency projected, appropriated for, and completed a 21-foot draft channel from the mouth of the river to Ashland Avenue, the latter have straightened the stream to some extent and provided depths as great as 26 feet over most of the South Branch. Had the sanitary district not done their work the United States would have been required to maintain the channel at project depth since about 1914. Navigation is no beneficiary of the greater depths provided by the sanitary district, as the

depths can not be availed of. It is true that current velocities would be greater with equal discharges if the depths were less, but as the production of any current is chargeable to the sanitary district no benefits can be claimed on that account.

The hydraulic grade line of the stream having been reversed, prevailing depths away from the lake have been lessened and the United States has been required to dredge a little more to obtain project depths than it would have been without the diversion. The cost is believed to be negligible.

There was practically no current in the river in its original condition. As a result navigation was comparatively simple where ample depth and width of channel existed. The introduction of current in the river by the sanitary district has been a distinct disadvantage. While the average current may not exceed 1½ miles per hour, there are places and times where currents of 3 to 4 miles per hour have been observed. Sometimes a large vessel gets caught in one side of the draw of a swing bridge, having become unmanageable as a result of the current. Vessels have been known to collide with each other or with the fenders of bridges or dock walls for the same reason. This is a damage of an indefinite valuation which is directly chargeable against the sanitary district.

The sanitary district has improved conditions on the river by constructing 12 modern bascule bridges of large span and clearance in the place of an equal number of swing bridges which were obstructions to navigation. It is highly probable, however, that the work would have been done by the city of Chicago had the sanitary district not taken the initiative. The funds for building the bridges came from the same source, the only difference was in the agency. Too much credit should not reflect on the sanitary district on this account, though it must be granted that the results are a distinct improvement and were accomplished more expeditiously than they would have been otherwise."

Exhibit 1 p. 37.

Report of Major Putnam, U. S. District Engineer,
Nov. 1923.

"No immediate valuation can be placed on the benefits to navigation resulting from these changes and additions to the channels in and near Chicago. The present value is doubtful, and while there is no question as to the future value of the main and Sag canals when the Illinois waterway is completed, the latter improvement is rather far from realization to make any good estimates.

Suppose, on the other hand, that these channels did not exist and either the State of Illinois or the Federal Government were called upon to provide a through channel from Chicago to Joliet of suitable dimensions for barge navigation. The dimensions of such a canal would probably be from 160 feet to 200 feet wide in rock cut, 160 feet wide at bottom of earth cut, and about 10 feet deep (see Plate V.)"

Exhibit 1 p. 39.

Report of Major Putnam, U. S. District Engineer, Nov. 1923.

"NAVIGATION.

As far as the navigation of the Chicago River and the drainage canal is concerned, if the flow at Lockport were entirely throttled and the power-house gates closed so as to permit no diversion from Lake Michigan, conditions would be decidedly improved. The current which now averages 1½ miles per hour and in some bridge draws is as high as 4, would be practically eliminated, making navigation considerably simpler, especially for the larger vessels whose passage through a narrow bridge draw is apt to increase the current materially."

Exhibit 1 p. 60.

Report of Major Putnam, U. S. District Engineer, Nov. 1923.

APPENDIX "D."

"Mr. Dietz. Defendants offer in evidence as Exhibit 1270 photostatic copies of the title and the first part of the Rivers and Harbors Act of June 25, 1910, and photostatic copy of the pages or portions of that act which provide an appropriation of one million dollars for the construction of a waterway from Lockport, Illinois, by way of the Des Plaines and Illinois Rivers to the mouth of said Illinois River.

(The document referred to is received in evidence and marked "Defendants' Exhibit No. 1270.")

Mr. Dietz. Defendants also offer in evidence as Exhibit No. 1271 two photostatic sheets of the report of the engineers on the subject of the waterway from Lockport, Illinois, by way of the Des Plaines and Illinois Rivers to the mouth of the Illinois River, showing that the $1,000,000 appropriation provision referred to in Exhibit 1270 was repealed.

Mr. Jackson. What was the date of the Chief of Engineer's report, Exhibit 1271?

Mr. Dietz. The date of the report itself?

Mr. Jackson. Yes.

Mr. Dietz. I think that is in evidence. Do you know, Mr. Barnes?

The Witness. No.

Mr. Dietz. We will get it for you.

(The document referred to is received in evidence and marked "Defendants' Exhibit No. 1271.")"

Transcript Vol. 27 pp. 6198-6199.

"IMPROVEMENT OF RIVERS AND HARBORS.

June 25, 1910. Vol. 36 p. 630.

(H. R. 20686) (Public. No. 264.)

CHAP. 382—An Act Making appropriations for the construction, repair, and preservation of certain public works on rivers and harbors, and for other purposes.

Rivers and Harbors appropriations.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the following sums of money be, and are hereby, appropriated, to be paid out of any money in the Treasury not otherwise appropriated, to be immediately available, and to be expended under the direction of the Secretary of War and the supervision of the Chief of Engineers, for the construction, completion, repair, and preservation of the public works hereinafter named:

Waterway from Lockport, Ill., to Mississippi River. Board to be appointed.

For the construction of a waterway from Lockport, Illinois, by way of the Des Plaines and Illinois Rivers to the mouth of said Illinois River, one million dollars. The Secretary of War shall appoint a board of five members, to be composed of four engineer officers of the army and one civil engineer taken from civil life. The president of the board of five members authorized under Act of March second, nineteen hundred and seven to examine the Mississippi River below Saint Louis and report to Congress on the project of a fourteen-foot channel, shall be a member of and president of the board herein provided for.

Nature of report.

Said board shall report upon the feasibility of such waterway, and the most advisable depth and dimensions therefor, in case the same is recommended; also upon such measures as may be required to properly preserve the levels of the Great Lakes and to compensate, so far as practicable, for the diminished level in said lakes and the connecting waters thereof by reason of any diversion of water from Lake Michigan for the maintenance of the proposed waterway herein described, or diversion for any other purpose; and further, also upon the influence on volume and height of waters in the Mississippi River below Cairo; and further, also, as to the effect upon the climate of the Lake States by a change in the natural currents of Lake Michigan.

Extent of cooperation of Illinois.
Recommendations.

The board shall, after full conference with the authorized agency of the State of Illinois, submit a report upon the extent to which the United States may properly cooperate with the State of Illinois in securing the construction of a navigable waterway from Lockport to the mouth of the Illinois River in conjunction with the development of water power by said State between Lockport and Utica, for which the people of the State of Illinois have authorized their general assembly to appropriate twenty million dollars; the report shall state the extent and character of the cooperation recommended and the conditions considered necessary in connection therewith to fully protect the interests of the United States.

Plans and estimates to be submitted.

Should the board consider cooperation to be advisable, the report herein called for shall include plans and estimates of cost of the work recommended to be done by the United States alone or in cooperation with the State of Illinois; and until these plans and estimates have been submitted and a project for the improvement adopted by Congress the appropriation of one million dollars herein made shall not be available for expenditure.

Report on dams at Jefferson Barracks and Commerce.

The board also shall consider and report upon the improvement of the Mississippi between the mouth of the Illinois River and the mouth of the Ohio River by the construction of a dam at or near Jefferson Barracks and a dam at or near Commerce, and the development of water power incidentally created by such dams. In the performance of its duties the board may consider all reports heretofore made; and the force, plant, and records of the Mississippi River Commission and the several engineer districts between Chicago and Cairo shall be available for the use of the board. The members of the board herein authorized shall be entitled to compensation at the rate

of six thousand dollars per annum, but the official salary of any officer appointed on said board from the Engineer Corps of the Army shall be deducted from the compensation provided for in this Act. For salaries and expenses of said board, including all necessary clerical and other personal services, there is hereby appropriated the sum of fifty thousand dollars. The reports herein called for shall be submitted to the Chief of Engineers not later than November first, nineteen hundred and ten, reviewed by the Board of Engineers for Rivers and Harbors, and submitted to Congress not later than the first Monday in December, nineteen hundred and ten.

Exhibit 1270.

WATERWAY FROM LOCKPORT, ILL., BY WAY OF THE DES PLAINES AND ILLINOIS RIVERS, TO THE MOUTH OF THE ILLINOIS RIVER, ETC.

Under the provisions of section 1 of the river and harbor act of June 25, 1910, a board, consisting of Brig. Gen. William H. Bixby, Chief of Engineers, United States Army; Col. C. McD. Townsend Corps of Engineers; Maj. Charles Keller, Corps of Engineers; Maj. J. B. Cavanaugh, Corps of Engineers; and Mr. John Bogart, civil engineer, was appointed by the Secretary of War to consider and report upon the construction of a waterway from Lockport, Ill., by way of the Des Plaines and Illinois Rivers, to the mouth of the said Illinois River; the said board to report upon the feasibility of such waterway and the most advisable depth and dimensions therefor, in case the same is recommended; also upon such measures as may be required to properly preserve the levels of the Great Lakes and to compensate as far as practicable for the diminished levels in said lakes and the connecting waters thereof by reason of any diversion of water from Lake Michigan, etc. The said act made an appropriation of $1,000,000, subject to the provision that "until these plans and estimates have been submitted and a project for the improvement adopted by Congress the appropriation of one million dollars herein made shall not be available for expenditure."

Reports dated November 1, 1910, and January 23, 1911, on the proposed waterway and certain related subjects called for by the said act were transmitted to Congress and printed in House Documents Nos. 1061 and 1374, Sixty-first Congress, third session, respectively.

Final report on the above and all related subjects was submitted on August 15, 1913, transmitted to Congress, and printed in House Document No. 762, Sixty-third Congress second session, which also includes a reprint of the partial reports of November 1, 1910, and January 23, 1911. A project is presented by the special board which involves an original outlay by the United States of $1,050,000 for the Illinois River and $3,710,000 for the Mississippi River, or a total of $4,760,000 for a navigable channel 8 feet deep from Utica to St. Louis.

By the provisions of section 12 of the river and harbor act approved March 4, 1915, the section of law appropriating the $1,000,000 above referred to was repealed and the balance of the appropriation remaining unexpended required to be covered back into the Treasury. No portion of the appropriation had been expended, and it will all be covered back into the Treasury in accordance with the law mentioned.

Excerpt, Report of Chief of Engineers, 1915.

Exhibit 1271.

APPENDIX "E."

"EXCERPTS FROM HEARING BEFORE THE COMMITTEE ON RIVERS AND HARBORS AND THE SENATE COMMERCE COMMITTEE RELATIVE TO THE AMOUNT OF WATER REQUIRED FOR PURPOSES OF NAVIGATION ALONG THE ILLINOIS RIVER.

Excerpts are from the following documents:

Hearings before the Select Committee on Nine-Foot Channel from the Great Lakes to the Gulf. U. S. Senate, Sixty-eighth Congress, Second Session, Vol. 2, 1925.

Hearings before the Committee on Rivers and Harbors, House of Representatives, Sixty-Ninth Congress, First Session, 1926.

Hearings before the Committee on Commerce, U. S. Senate, Sixty-Ninth Congress, First Session, H. R. 11616.

HEARINGS

BEFORE THE

SELECT COMMITTEE ON NINE-FOOT CHANNEL FROM THE GREAT LAKES TO THE GULF UNITED STATES SENATE

Sixty-Eighth Congress
Second Session
Vol. 2-1925

Senator Brookhart. One of the matters we would like to know about is the amount of water that would be required at Chicago for navigation of the 9-foot channel down the Illinois River.

General Taylor. That is a matter which has been under investigation a number of times. I think the first formal report that was made on it was made by a board which was convened by authority of the river and harbor act of June 25, 1910. In the report of that board it was stated a number of times that a diversion of more than 1,000 second-feet is not necessary for navigation purposes.

On page 14 of House Document No. 762, Sixty-third Congress, second session, this statement appears:

But the board reiterates that a diversion exceeding 1,000 second-feet is not necessary for navigation purposes alone in the Illinois River, and that an added discharge will produce a slight and inadequate effect on the Mississippi River.

Statements to that same effect are found in numerous places in that report.

It has been investigated a number of times and I think the conclusions reached by that Board have always been concurred in.

Of course, the amount of water depends entirely upon how the improvement shall be made. We could get 8 or 9 feet in the Illinois River with 1,000 second-feet or with 10,000 second-feet diversion but by different methods of improvement and at different costs.

* * * * *

Senator Brookhart. That is with or without locks?

General Taylor. With 1,000 second-feet you would have to have locks and with 10,000 second-feet no locks would be required; that is, below Utica.

Exhibit 209.

HEARINGS

BEFORE THE

COMMITTEE ON RIVERS AND HARBORS

HOUSE OF REPRESENTATIVES

Sixty-Ninth Congress

First Session 1926

Mr. Mooney. I see, but you have had no reason for changing your own opinion that 1,000 cubic feet is all that is necessary for navigation?

General Taylor. It is all set out in this report, the various costs of the project under various amounts of diversion, ranging from—there is a table on page 3 which shows what can be done with various amounts of diversion, what the costs will be, with average diversion, ranging from 1,000 second-feet to 10,000 second-feet.

The Chairman: This is for an average of 1,650 feet maximum?

General Taylor. Yes, sir.

Mr. Mooney. Pardon me. I am asking this because I really want to know. You have not changed your judgment that by the expenditure of that money that navigation can be provided for any of these amounts which you have named?

General Taylor. That is correct.

General Taylor. It is shown in the table and published in the report that the channel can be obtained with any amount of diversion annually from 1,000 up to 10,000. That answers your question.

Exhibit 209.

"HEARINGS

BEFORE THE

COMMITTEE ON COMMERCE
UNITED STATES SENATE

Sixty-Ninth Congress
First Session
on
H. R. 11616

General Taylor. There is a certain amount of water used for domestic purposes, approximately 1,200 second-feet, and that would go back into the river and go down the river. With a diversion there at Lockport of only 1,000 second-feet, which is less than the amount they are using at the present time for domestic consumption, the cost would vary. With complete canalization it would be $2,666,000, and with partial canalization, by taking the State dams out, it would be $5,133,000. In other words, with a flow from the lake of only 1,000 second feet, the cost would be between $2,555,000 and $5,133,000.

* * * * *

General Taylor. Yes, and in addition to that there are a number of streams that enter the river below Lockport that ordinarily give water enough so that even if we did not get any water from the lake in any form, this improvement would still be useful. There will be times of extreme low water, of course, when we would have to either limit the lockage or perhaps suspend altogether, but those periods ordinarily would be short, and very infrequent. Many very important improvements are made where navigation would have to be closed for considerable periods of time. For instance, take the Great Lakes. They are closed for some five or six months every year, but nobody thinks they are not worth while making, because they are not available throughout the whole 365 days in the year. This waterway down the Illinois would be a perfectly good waterway and would be available for probably 99 per cent

of the time, even if there was not any water taken from Lake Michigan.

* * * * *

Senator Copeland. If the diversion is limited to 1,200 feet, the present amount used for domestic purposes, what will be the cost of this improvement?

General Taylor. With the diversion of 1,000 second-feet on an average, it would be, with complete canalization $2,666,000 and with partial canalization $5,133,000. In other words, it will vary between, in round numbers, two and a half million dollars and a little over $5,000,000.

* * * * *

Senator Willis. So that any diversion other than a thousand second-feet is for some purpose other than navigation.

General Taylor. Navigation can be provided for with a thousand second-feet."

Exhibit 209, Transcript Vol. 40(2) pp. 9243-9245.

APPENDIX "F."

"5. For any of the three depths referred to in the resolution, the river can be improved by two or more of at least four different methods, viz., (1) complete canalization, using five locks and dams; (2) partial canalization, using the four existing locks and dams; (3) partial canalization, using the two existing Federal locks and dams and partially removing the two State dams; and (4) open-channel improvement, involving partial removal of all four dams. The district engineer submits estimates on all the cases involved. The division engineer and the board concur in his estimates, subject to the qualifications contained in paragraph 7 (e) of the board's report. The following condensed table shows costs for a 9-foot channel:

Illinois River, Ill.

Method of Improvement	Instantaneous maximum diversion, Lockport, cubic feet per second	Annual average diversion, Lockport, cubic feet per second	Cost, thousands of dollars [1]		
			First cost	Maintenance and operation	Annual charge (maintenance and operation) plus 4 per cent first cost
Complete canalization [2]	1,650	1,000	2,666	226	[2]333
Partial canalization (State dams out)			5,133	210	415
Complete canalization [2]	3,300	2,000	2,619	216	[2]321
Partial canalization [2] (State dams out)			5,108	171	375
Open channel			6,050	105	347
Partial canalization (present dams retained) [2]	4,580	3,000	1,914	191	[2]268
Partial canalization (State dams out)			3,697	147	295
Open channel			4,482	97	277
Partial canalization (present dams retained)	6,050	4,167	1,383	180	235
Partial canalization (State dams out) [2]			2,262	133	[2]224
Open channel			3,465	89	277
Partial canalization (present dams retained)	7,050	5,000	1,264	178	229
Partial canalization (State dams out)			1,789	130	202
Open channel [2]			2,365	87	[2]182

[1] On the assumption that the flow is regulated primarily in the interests of navigation.

[2] Indicates method which, considering, first, maintenance and operation costs, is cheapest, in terms of Federal money expended, for the given diversion."

Method of Improvement	Instantaneous maximum diversion, Lockport, cubic feet per second	Annual average diversion, Lockport, cubic feet per second	Cost, thousands of dollars [1] First cost	Maintenance and operation	Annual charge (maintenance and operation) plus 4 per cent first cost
Partial canalization (present dams retained)	8,250	6,000	1,141	168	214
Partial canalization (State dams out)			1,349	126	180
Open channel [2]			1,925	80	[2]157
Partial canalization (State dams out)	10,050	7,500	942	122	160
Open channel [2]			1,540	76	[2]138
Partial canalization (State dams out)	11,250	8,500	171	114	[2]121
Open channel			1,320	70	123
Partial canalization (State dams out)	13,050	10,000	171	105	112
Open channel [2]			990	63	[2]102

[1] On the assumption that the flow is regulated primarily in the interests of navigation.

[2] Indicates method which, considering, first, maintenance and operation costs, is cheapest, in terms of Federal money expended, for the given diversion."

Exhibit 18 p. 2, 3.

House Doc. 4, 69th Cong. 1st Sess.

Report of Board of Engineers for Rivers and Harbors on Illinois River, Illinois.

"7. On the basis of the data in the reports of the district and division engineers, the board states that the least possible diversion which will permit of 9-foot navigation at all times in the Illinois River may be taken as approximately 1,000 cubic feet per second annual average and 1,650 cubic feet per second instantaneous maximum, based on the worst navigation conditions of record in the Illinois River, and subject to the qualifications contained in paragraph 7 (e) of the board's report. This figure is approximate only, since it involves complete canalization of the Illinois and is computed on the flow necessary for lockages, with due allowance for seepage, evaporation, etc.;

and computations on lockages necessarily turn on assumptions as to the future traffic."

Exhibit 18 p. 3.
House Doc. 4, 69th Cong. 1st Sess.
Report of Board of Engineers for Rivers and Harbors on Illinois River, Illinois.

"8. The estimated cost of a navigation improvement, which is the question asked, depends both on the amount of diversion and the method of improvement. For any of the three depths, the river can be improved by one or more of at least four different methods; complete canalization, using five locks and dams; partial canalization, using the four existing locks and dams; partial canalization, using the two existing Federal locks and dams and taking out the two State dams; and open channel improvement. The following table shows, for a channel 9 feet by 200 feet, the costs by these methods, for the five diversions given in the resolution and for additional diversions as well (1,000, 3,000, 5,000 and 6,000 c.f.s.). It is assumed that by 'diversions' the committee meant 'average annual diversions based upon the year most unfavorable to navigation.' (Par. 7-c, col. 1). The diversion engineer concurs in these cost estimates. The board also concurs and submits them, as the answer to the first question, as regards the 9-foot depth. Data on 7-foot and 8-foot depths and certain alternative estimates for 9-foot depths appear in the district engineer's report and appendices thereto. (Table in preceding quotation then follows.)"

Exhibit 18 p. 10.
House Doc. 4, 69th Cong. 1st sess.
Report of Board of Engineers for Rivers and Harbors on Illinois River, Illinois.

APPENDIX "G."

16. Illinois River, LaSalle to the mouth.—The existing Federal project adopted in 1880 provides, in connection with the State project, for a navigable channel 7 feet deep at low water of 1879 from LaSalle to the mouth of the river, by the construction of four locks and dams and dredging the bars.

Exhibit 18, H. Doc. 4, 69th Cong.
1st Session, page 175.

Report of Board of Engineers for Rivers and Harbors on Illinois River, Illinois.

18. Illinois River, LaSalle to the mouth.—The existing Federal project adopted in 1880 provides, in connection with the State project, for a navigable channel 7 feet deep at low water of 1879 from LaSalle to the mouth of the river, by the construction of four locks and dams and dredging the bars. From LaSalle to Copperas Creek, the upper limit of the original United States project, the State of Illinois has made the improvement, principally by the construction of locks and dams at Henry and Copperas Creek, 27.2 and 86.5 miles, respectively, below LaSalle. From Copperas Creek to the mouth United States has improved the river by dredging and construction of locks and dams at LaGrange and Kampsville, 145.6 and 191.7 miles, respectively below LaSalle. The full width of channel has not yet been accomplished but low water mid-channel depths in the open river are in excess of 7 feet for a width of

about 75 feet. All locks mentioned are 350 feet long and 75 feet wide with 7 feet on miter sills. All dredging since 1914 has been done by the United States dredging plant, and to a depth of 7 feet below low water of 1901, the lowest stage of river since the opening of the Sanitary Canal.

Exhibit 1360, H. Doc. 2, 67th Cong.
1st Sess., page 9.

Report by U. S. District Engineers, on Illinois and Mississippi Rivers between Utica and Cairo, Ill.

2. The Illinois River is formed by the confluence of the Kankakee and Des Plaines Rivers in northeastern Illinois and flows generally west and south for 273 miles into the Mississippi River. It is under improvement by the United States in accordance with a project providing for a channel 7 feet deep at low water of 1879 from the mouth to LaSalle, a distance of 223 miles, to be obtained by two Federal locks and dams, at Kempsville and LaGrange, respectively, and by dredging. There are two other locks and dams in this stretch of the river, at Henry and at Copperas Creek, which were built and are operated and maintained by the State of Illinois, and for passage through which the State charges tolls; these were however necessary for navigation up to LaSalle previous to the present large diversion of water from Lake Michigan.

Exhibit 18, H. Doc. 4, 69th Cong.
1st Sess., page 8.

Report of Board of Engineers for Rivers and Harbors on Illinois River, Illinois.

REPORT OF CHIEF OF ENGINEERS,
U. S. ARMY, 1890, Part I, page 261.

"The present project contemplates the extension of the work heretofore done by the State of Illinois from the mouth of the Copperas Creek to the Mississippi River, a distance of about 135 miles, which project includes the building of two locks, 350 feet long, between mitre-sills, 75 feet width of lock chamber, with 7 feet of water over the mitre-sills at low water of 1879, and dredging the channel where necessary to obtain 7 feet depth at low water in the pools thus created."

REPORT OF CHIEF OF ENGINEERS,
U. S. ARMY, 1893, Part I, p. 362.

"The present project was adopted in 1880, and contemplates the extension of the slack-water improvement begun by the state of Illinois from the mouth of Copperas Creek to the Mississippi River a distance of about 135 miles."

"The project includes the construction of two locks 350 feet long between mitre sills, 75 feet in width of lock chamber, with a depth of 7 feet in water over sills at low water of 1879, and dredging the channel where necessary to secure 7 feet depth of water at low water in the pools thus created."

This appears also in Report of Chief of Engineers, U. S. Army

1894, Part I, p. 334
1895, Part I, p. 372
Part IV, p. 2714
1896, Part I, p. 327
Part IV, p. 2597
1897, Part I, p. 416
1898, Part I, p. 404
1899, Part I, p. 480
1900, Part I, p. 505

Exhibit 207

REPORT OF THE CHIEF OF ENGINEERS,
U. S. ARMY, 1897, Pt. LV, p. 2815.

"The present project was adopted in 1880 and contemplates the extension of the slack-water improvement begun by the State of Illinois from the mouth of Copperas Creek to the Mississippi River at Grafton, Illinois, a distance of 135 miles. The project includes the construction of two locks each 350 feet in length of chamber, 75 feet in width, and with 7 feet depth at low water over sills, and dredging the channel where necessary to secure that depth of water at low water throughout the pools created by the dams."

This also appears in Report of Chief of Engineers, U. S. Army,

1898, Part IV, p. 2436	1900, Part V, p. 3799
1899, Part IV, p. 2841	1901, Part IV, p. 3006

Exhibit 207

REPORT OF CHIEF OF ENGINEERS,
U. S. ARMY, 1901, Part I.

Illinois River, Ill. (a) Below Copperas Creek—"The project, which contemplates the extension of slack-water improvement begun by the State of Illinois from Copperas Creek Lock to the Mississippi River, and which includes the construction of two locks, 350 feet long between sills, 75 feet width of chamber, with 7 feet of water over sills at low water of 1879, and dredging the channel where necessary to obtain 7 feet depth at low water was adopted in 1880. This also appears in Report of Chief of Engineers U. S. Army

1902, Part I	1908, Part 1, p. 682
1903, Part I	1909, Part I, p. 718
1904, Part I, p. 541	1910, Part I, p. 796
1905, Part I, p. 548	1911, Part I, p. 853
1906, Part I, p. 609	1912, Part I, p. 1012
1907, Part I, p. 635	1913, Part I, p. 1133

Exhibit 207

REPORT OF CHIEF OF ENGINEERS,
U. S. ARMY, 1907, Part I, p. 636.

"(b) From Copperas Creek to LaSalle. The first appropriation for this section of the River was made March 2, 1907, and the approved project for its expenditure provides for securing the same navigable conditions from Copperas Creek to LaSalle as are planned for the lower river i.e. a channel depth of 7 feet at low water."

This also appears in report of Chief of Engineers, U. S. Army

1908, Part I, p. 682
1909, Part I, p. 719-20
1910, Part I, p. 797
1911, Part I, p. 835
1912, Part I, p. 1021
1913, Part I, p. 1133

Exhibit 207

REPORT OF CHIEF OF ENGINEERS,
U. S. ARMY, 1910, Part II, pp. 2164-65.

Improvement of Illinois River, (a) Below Copperas Creek

"The approved project provides for a channel 200 feet wide and 7 feet deep at low water of 1879."

This appears also in Report of Chief of Engineers, U. S. Army,

1911, Part II, pp. 2367-2368
1912, Part II, p. 2555
1913, Part II, p. 2817

Exhibit 207

REPORT OF CHIEF OF ENGINEERS,
U. S. ARMY, 1912, Part I, p. 1020, *et seq.*

Illinois River, Illinois.

"Improvement work is referred to Memphis datum which is 587.04 feet below Chicago City datum, or 7.01 feet below New York mean tide." (p. 1021)

"(a) Below Copperas Creek. The project, which contemplates the extension of slack-water improvement begun

by the state of Illinois from Copperas Creek Lock to the Mississippi River, and which includes the construction of two locks 350 feet long between sills, 75 feet width of chamber, with 7 feet of water over sills at low-water level of 1879, and dredging the channel where necessary to obtain 7 feet depth at low water, was adopted in 1880." (p. 1021)

"(b) From Copperas Creek to LaSalle.—The first appropriation for this section of the River as made March 2, 1907, and the approved project for its expenditure provides for securing the same navigable conditions from Copperas Creek to LaSalle as are planned for the lower river, i.e., a channel depth of 7 feet at low water.

Exhibit 207

REPORT OF CHIEF OF ENGINEERS,
U. S. ARMY, 1914, Part I, pp. 1170-72.

Illinois River, Ill. "The admission to the Illinois River of Lake Michigan water via the Chicago Drainage Canal has raised the lower water plane; but inasmuch as the quantity of water which may thus be admitted is a matter of present litigation, it is impracticable, as yet, to ascertain what the low water plane will be." (p. 1171)

"(a) Below Copperas Creek (General Improvement) The existing project for work below Copperas Creek adopted in Act of June 14, 1880, contemplates improvement to a 7 foot depth at low water by dredging and by the construction of one lock each at Kampsville, 31 miles above the mouth of the river (completed and in use since 1894), and at LaGrange, 79 miles above the mouth (completed and in use since 1890). Each lock is 350 feet long, between sills and 75 feet wide, with 7 feet on the mitre sills at low water of 1879. Estimated cost $1,692,837.81. There has been no modification of this project. (p. 1171).

"(b) Copperas Creek to LaSalle. At the lower end of this section 137 miles above the mouth of the river, and at Henry, 199 miles above the mouth, the state of Illinois, assisted by the United States has built locks 350 feet long between sills and 75 feet wide with 7 feet on the mitre sills

at low water of 1879. The state operates these locks and imposes charges for their use." (p. 1172).

Exhibit 207

ANNUAL REPORT OF CHIEF OF ENGINEERS, U. S. ARMY, 1915, Part 1, p. 1266.

Illinois River (Note on p. 1266) 1. "The admission to the Illinois river of Lake Michigan water via the Chicago Drainage Canal has raised the low water plane; but inasmuch as the quantity of water that may thus be admitted is a matter of present litigation, it is impracticable to ascertain what the future low water plane will be. At present there is admitted nearly 8000 cubic feet per second as against 4,166 cubic feet per second authorized."

2. "Improvement work is referred to Memphis datum, which is 587.04 feet below Chicago City datum, or 7.01 feet below New York mean tide."

"(a) Below Copperas Creek (General Improvement); The existing project for work below Copperas Creek adopted in Act of June 14, 1880, contemplates improvement to a 7 foot depth at low water by dredging and by the construction of one lock each at Kempsville, 31 miles above the mouth of the river, and at LaGrange, 79 miles above the mouth. Each lock is 350 feet long between sills and 75 feet wide with 7 feet on the mitre sills at low water at 1879." (p. 1256).

"(b) Copperas Creek to LaSalle: At the lower end of this section, 137 miles above the mouth, the State of Illinois assisted by the United States has built locks 350 feet long, between sills and 75 feet wide with 7 feet on the mitre sills at low water of 1879." (p. 1267.)

Note on bottom of page in above reports as follows:

"The admission to the Illinois river of Lake Michigan water via the Chicago Drainage Canal has raised the low water plane; but inasmuch as the quantity of water that may thus be admitted is a matter of present litigation,

it is impracticable, as yet, to ascertain what the future low-water plane will be."

This appears also in the report of Chief Engineers, U. S. Army

1917, Part	I, p. 1423	1920, Part	I,
1918, Part	I, p. 1470	1921, Part	I, p. 1575
1919, Part	I, p. 1595	1922, Part	I, p. 1593

Exhibit 207

A. R. Chief of Engineers, U. S. Army, 1916, Part I, p. 1367.

Illinois River "(a) Below Copperas Creek (General Improvement) The existing project for work below Copperas Creek adopted in River and Harbor Act of June 14, 1880, contemplates improvement to a 7 foot depth at low water by dredging and by the 31½ miles above the mouth of the river, and at La Grange, 77½ miles above the mouth. Each lock is 350 feet long between sills and 75 feet wide, with 7 feet on the miter sills at low water at 1879." (p. 1368)

(b) Copperas Creek to LaSalle. Since 1880 this section had not been a part of the general improvement prosecuted by the United States, but the River and Harbor Act of March 2, 1907, specifically appropriated $50,000.00 for this section, to be applied to dredging and other improvements.

This appears also in report of Chief of Engineers, U. S. Army

1917, Part	I, p. 1423	1920, Part	I,
1918, Part	I, p. 1470	1921, Part	I, p. 1576
1919, Part	I, p. 1595		

REPORT OF CHIEF OF ENGINEERS,
U. S. ARMY, 1922, Part I, p. 1593.

Illinois River.

"Existing project. This provides for the improvement of the River from its mouth to Copperas Creek, a

distance of 137 miles, by construction of two locks and dams, and by dredging to afford a depth of 7 feet at low water of 1879; and for the improvement of the river from Copperas Creek to LaSalle, a distance of 86 miles, by dredging and other improvements, to afford the same depth.

Exhibit 207

REPORT OF CHIEF OF ENGINEERS,
U. S. ARMY, 1923, Part I, p. 1451.

Existing project. This provides for the improvement of the river from its mouth to LaSalle, a distance of 223 miles, by the construction of two locks and dams, and by dredging to afford a depth of 7 feet at low water of 1879.

This appears also in report of Chief of Engineers United States Army

1924, Part I, p. 1448 1924, Part I, p. 1358

"Existing project. This provides for the improvement of the river from its mouth to LaSalle a distance of 223 miles, by the construction of two locks and dams, and by dredging to afford a depth of 7 feet at low water of 1879." (p. 1378)

"2. The admission to the Illinois river of Lake Michigan water via the Chicago Drainage Canal has raised the low water plane, but inasmuch as the quantity of water that may thus be admitted is subject to progressive production, it is impracticable as yet to ascertain what the future low water plane will be." (p. 1378)

Exhibit No. 207.

"Illinois River, Illinois: Modification of existing project so as to provide a channel with least dimensions of nine feet in depth and two hundred feet in width from the mouth to Utica: Provided, That the State of Illinois transfers to the United States without cost all rights and titles in the two State-owned dams on the Illinois River; and that

local interests furnish the United States without cost all necessary areas for the economical disposal of material dredged in creating and maintaining the channel herein and hereby authorized: Provided further, That nothing in this Act shall be construed as authorizing any diversion of water from Lake Michigan: Provided further, That there is hereby authorized to be appropriated for the project a sum not to exceed $3,500,000."

Rivers and Harbors Act, 1926.
Exhibit 214, Transcript 9255.

APPENDIX "H."

"And whereas, in the judgment of the Secretary of War, an annual average diversion of more than 8,500 cubic feet per second should not now be permitted;

"Now therefore, this is to certify that, upon the recommendation of the Chief of Engineers, the Secretary of War, under the provisions of aforesaid statute, hereby authorizes the said Sanitary District of Chicago to divert from Lake Michigan, through its main drainage canal and auxiliary channels, an amount of water not to exceed an annual average of 8,500 cubic feet per second, the instantaneous maximum not to exceed 11,000 cubic feet per second, upon the following conditions:

Exhibit 12, Doc. 45, Trans. 433.

Permit of March 3, 1925.

"U. S. Engineering Office, Chicago, Ill., March 2, 1925.
To the Chief of Engineers, Washington, D. C.

"1. This is an application from the Sanitary District of Chicago, a municipality created under the laws of the State of Illinois, to divert 10,000 cubic feet per second of water from Lake Michigan, for the purpose of keeping the sewage of that locality from contaminating its water supply and for reducing the sewage by dilution.

* * * * *

"4. In the issuance of a permit, the exact meaning of the word 'diversion' should be understood. In the recommendations which follow, by diversion is meant the amount of water which is actually withdrawn from Lake Michigan by the Sanitary District of Chicago through its main drainage canal and auxiliary channels, and is not inclusive of the amount flowing in the channels which come from the sewers of the locality.

"In other words, 'diversion' is taken to be the gross flow at Lockport less the amount of water used by the city of Chicago for domestic purposes."

5. It is recommended that a permit be issued to the Sanitary District of Chicago, covering a period of five years, to divert from Lake Michigan, through its main

drainage canal and auxiliary channels, an amount of water not to exceed an annual average of 8,500 cubic feet per second; the instantaneous maximum not to exceed 11,000 cubic feet per second. This permit should be made conditional upon the following:

Exhibit 12, Doc. 43, Trans. 418, 419, 420.
Report of District Engineer on application of Sanitary Dist. for Permit of March 3, 1925.

November 24, 1925.

His Excellency,
The Right Honorable
Sir Esme Howard, G. C. M. G., K. C. B., C. V. O.,
Ambassador of Great Britain.

Excellency:

Referring further to your Embassy's note No. 813 of September 15, 1925, bringing to my attention certain remarks and inquiries of the Canadian Government in regard to the diversion of water from Lake Michigan by the Sanitary District of Chicago, I take pleasure in submitting the following statements:

* * * * *

The expression "measured at the intakes," used to designate the places where the total actual flow should not exceed that specified in the permit, is hypothetical as it is impracticable to measure the diversion at the numerous intakes with accuracy. For this reason, the practical enforcement of the limitation placed upon the diversion will be carried out at Lockport. Measurements taken there will determine the gross diversion, sanitary and domestic, and, as accurate information is available in regard to the amount of water pumped by the City of Chicago for domestic purposes, the sanitary diversion may be computed by subtracting the domestic diversion from the gross flow at Lockport.

"The term 'diversion' as used in the permit is construed to include the discharge of the Chicago and Calumet Rivers. In view of the methods employed in computing the amount of the diversion the discharge of these streams

will be included within the 8,500 cubic feet per second authorized by the permit of March 3, 1925."

Ex. 17, Tr. 442-443.
Diplomatic correspondence between United States and Great Britain.

SANITARY DISTRICT OF CHICAGO
MAXIMUM OR PEAK FLOW AND K. W. OUTPUT

1920 to 1926 inclusive.

Items 4 & 5		*K. W.*	*Total C. F. S.*
1920 June 20	3:05 A. M.	18,950	19,610
1921 June 25	12:30 Noon	7,700	13,325
1922 July 3	8:00 A. M.	9,800	14,715
1923 Aug. 11	10:30 A. M.	12,500	15,385
1924 Aug. 6	12:00 M. N.	17,900	13,285
1925 Nov. 16	5:00 P. M.	25,000	13,415
1926 Sept. 23	4:30 P. M.	17,600	12,765

Exhibit 146.

SANITARY DISTRICT OF CHICAGO

Tabulation of Flow in Sanitary and Ship Canal

Year	Total Flow at Lockport	Sewage Flow (Chicago Water Works Pumpage)	Water directly abstracted from Lake Michigan by Sanitary District
1900	2990 C.F.S.	449 C.F.S.	2541 C.F.S.
1901	4046 "	531 "	3515 "
1902	4302 "	554 "	3748 "
1903	4971 "	582 "	4389 "
1904	4793 "	618 "	4175 "
1900-04	4220 "	547 "	3673 "
1905	4480 "	636 "	3844 "
1906	4473 "	676 "	3797 "
1907	5116 "	704 "	4412 "
1908	6443 "	726 "	5717 "
1909	6495 "	744 "	5751 "
1905-09	5401 "	697 "	4707 "
1910	6833 "	803 "	6036 "
1911	6896 "	785 "	6111 "
1912	6938 "	853 "	308[illegible] "
1913	7839 "	894 "	6945 "
1914	7815 "	949 "	6866 "
1910-14	7264 "	857 "	6407 "
1915	7738 "	939 "	6799 "
1916	8200 "	972 "	7228 "
1917	8726 "	993 "	7733 "
1918	8826 "	1018 "	7808 "
1919	8595 "	1106 "	7489 "
1915-19	8417 "	1006 "	7411 "
1920	8346 "	1176 "	7170 "
1921	8355 "	1199 "	7156 "
1922	8858 "	1216 "	7642 "
1923	8348 "	1220 "	7128 "
1924	9465 "	1274 "	8191 "
1920-24	8674 "	1217 "	7457 "
1925	8278 "	1338 "	6940 "
1926	8283 "	1395 "	6888 "

Ex. 1111, Tr. 3361-2.

1. That there shall be no unreasonable interference with navigation by the work herein authorized.

Exhibit 12, Doc. 45, Trans. 433.
Permit of March 3, 1925.

Question 6 (a) To what extent and in what manner are the natural water levels in the St. Lawrence River and on the Great Lakes affected by diversions authorized by license by either Canada or the United States from or in the St. Lawrence River watershed?

237. Answer: The diversion by the Chicago Sanitary District of 8,500 cubic feet per second from the lake basin through the Chicago Drainage Canal, authorized by license by the United States, lowers the water levels on the Great Lakes and the St. Lawrence River as follows:

	Foot
Lakes Michigan and Huron	0.5
Lake Erie	.4
Lake Ontario	.4
St. Lawrence River between Lake Ontario and Montreal:	
At Prescott	.4
At Lock 25 (Iroquois)	.6
At Lock 23 (Morrisburg)	.5
At Lock 21 (Dickensons Landing	.4
At Lock 15 (Cornwall)	.3
Lake St. Francis	.2
Lake St. Louis	.3
St. Lawrence River at and below Montreal:	
At Montreal Harbor	.37
At Varennes	.35
At Sorel	.28
At Bastican	.24
At Lotbiniere	.24
At Platon	.17
At Quebec	.03

Exhibit 147, page 42.
Report of Joint Board of Engineers on St. Lawrence Waterway.

Q. Will you read into the record the result of your computation on the lowering of Michigan and Huron from the abstraction of 8,500 cubic second feet at the lake stage or stages used in your computation?

A. When Lake Huron is at an elevation of 581.0, and Lake Erie is at 572.5, we find that diversion of 8,500 cubic second feet will result in the lowering of the level of Lakes Michigan and Huron by .488 feet. When Lake Huron is at an elevation of 578, and Lake Erie is at an elevation of 570.25, we find that diversion of 8,500 cubic feet per second will result in the lowering of the lakes by .562 feet. Having regard to the inherent inaccuracies of the data, it is my conclusion that a diversion of 8,500 cubic feet per second would lower the levels of Lakes Michigan and Huron by .5 of one foot.

Pillsbury, Tran. 876.

Q. The figures which you have quoted there show an abstraction of 8,500 cubic second feet. Will you state whether the extent of the lowering would be directly proportional or otherwise for any abstraction of another amount?

A. It would be directly proportional.

Q. For instance, for 1,000 cubic second feet, it could be determined by dividing by 8.5?

A. Yes, sir.

Q. Colonel Pillsbury, did you make a computation with reference to the effect of a given abstraction from Lakes Michigan and Huron upon Lake Erie?

A. Yes, sir.

Q. What did you find to be the effect?

A. I find that when Lake Erie is at an elevation of 572.5, the effect of a diversion of 8,500 cubic second feet is point three eight six. When Lake Erie is at an elevation of 570.25, the effect of a diversion of 8.500 cubic second feet is .421. Having regard to the inaccuracies of the lake determinations, it is my conclusion that the effect of the diversion of 8,500 cubic feet per second from Lakes Michigan and Huron lowers the level of Lake Erie by .4 of a foot.

Q. At what lake stage?

A. At any lake stage. That within the range of stages actually occurring, the greatest accuracy warranted is the statement that it would lower the level of that lake by .4 of a foot. It would lower somewhat more at low stages than at high, but the difference is small.

Q. You referred to inaccuracies in the data. Did you have in mind some known error of undetermined extent, or errors that are necessarily present in the most careful measurements of stream flows?

A. The errors that are necessarily present in any determination of stream flow.

Pillsbury, Tran. 879-880.

Q. Colonel Pillsbury, have you from the records and computations, surveys, and investigations of the Lake Survey, made any determination or computation as to the effect of the abstraction through the Chicago Drainage Canal of an ascertained amount upon the level of Lake Ontario?

A. Yes.

Q. What conclusion did you reach?

A. I verified the effect found in what is known as the Warren Report.

Q. Can you express in feet or fractional parts of a foot the lowering from the given abstraction?

A. It was .4 of a foot for an abstraction of 8,500 cubic feet per second.

Pillsbury, Trans. 881.

Q. Colonel Pillsbury, will the lowering which you state to take place in Michigan and Huron be felt in all of the bays, inlets, rivers and harbor mouths in Lakes Michigan and Huron?

A. All those which are at the same level as the respective lakes.

Q. With a port at a harbor dredged out of a river mouth, would the lowering be felt in that dredged portion of the harbor?

A. Yes.

Q. And the effect which you have stated to take place in Lake Huron, would that be felt upon the lower St. Marys River?

A. By a slightly decreased amount as you proceed upstream.

Q. Up as far as the floor of the locks of the Soo?

A. Yes.

Q. State whether the effect of the abstraction or the lowering effect would be felt in the St. Clair River.

A. Yes.

Q. Would it be felt in Lake St. Clair?

A. Yes.

Q. Would it be felt in the Detroit River?

A. Yes.

Pillsbury, Trans. 881-882.

Q. You have stated that the extent of the lowering in Michigan and Huron would be directly proportional for variation of the amount of the abstraction?

A. Yes; for abstraction of the order here considered.

Q. Well, for instance, from 1,000 to 12,000 cubic feet per second?

A. Yes.

Q. Would the same condition apply with reference to the lowering of Lakes Erie and Ontario?

A. Yes.

Q. Will you state whether, in your opinion, a given abstraction through the Chicago Drainage Canal has any effect on lowering the St. Lawrence River.

A. Yes; it has.

Q. How far down the St. Lawrence does that lowering extend?

A. To Quebec.

Q. Where in relation to tidewater?

A. At Quebec the St. Lawrence is but slightly above sea level. It is tidal for a considerable distance above that, but the effect is felt on the tidal portion above Quebec, as well as in the non-tidal portion.

Q. Colonel, when I asked you about the lowering of Huron did I also ask you about the lowering of Michigan?

A. Michigan and Huron are substantially the same level. Anything that affects Huron affects in the same degree Lake Michigan.

Q. So that the figures which you may have stated for lowering of either Michigan or Huron would apply to the other lake?

A. Yes.

Pillsbury, Trans. 885-886.

I find that the full effect of a diversion of 8,500 c. s. f. of water from Lake Michigan at Chicago through the drainage canal of the Sanitary District would be to lower the levels of Lakes Michigan and Huron approximately six inches at mean lake levels; the levels of Lakes Erie and Ontario, approximately five inches at mean lake levels; and the levels of the connecting rivers, bays and harbors, so far as they have the same mean levels as the above-mentioned lakes, to the same extent, respectively.

By reference to the tabulation of flow in the Chicago Drainage Canal (*supra*, p. 22), it will be observed that the total flow at Lockport did not exceed 8,000 cubic second-feet until 1916, when it was 8,200 c. f. s., and from that time it exceeded 8,500 c. f. s. until 1920, when the total flow amounted to 8,346 c. f. s., and that the average from 1920 to 1924 was 8,674 c. f. s., and for the years 1925 and 1926 about 8,280 c. f. s. I find that the diversion which has taken place through the Chicago drainage canal has been substantially equivalent to a diversion of about 8,500 c. f. s. for a period of time sufficient to cause, and has caused, the lowering of the mean levels of the lakes and the connecting waterways practically to the extent above stated.

I find, further, that an increase of the diversion at Chicago above 8,500 c. f. s. would cause an additional lowering of the levels of the lakes and their connecting waterways in proportion to the amounts above stated. Thus a diversion of an additional 1,500 c. f. s. or a total diversion of 10,000 c. f. s. would cause an additional lowering in

Lakes Michigan and Huron of about one inch, and in Lakes Erie and Ontario a little less than one inch, with a corresponding additional lowering in the connecting waterways having the same levels as the lakes respectively.

Special Master's Report, pp. 104-05.

Q. The Complainants produce a document entitled: "Great Lakes Ship Channel, Duluth, Minnesota to Buffalo, New York," Document 270, House of Representatives, 69th Congress, First Session, which is marked "Complainants' Exhibit 67, for identification." Colonel Markham, I show you this exhibit and ask you whether you had any part in the preparation of that document?

A. I prepared a portion of that document, starting on page 11, beginning "War Department, United States Engineer Office, Detroit, Michigan; Subject; Preliminary examination of ship channel between Duluth and Buffalo," and continuing to my name on page 31.

Mr. Jackson. We offer Complainants' Exhibit No. 67 for identification in evidence.

Mr. Adcock. May I ask a few questions there?

Mr. Jackson. Yes.

Mr. Adcock. Was this report prepared pursuant to some Act of Congress?

A. Yes, sir; the law is quoted in the second or third paragraph on page 11.

Mr. Adcock. No objection.

The Special Master. It will be received and marked "Exhibit 67" in evidence.

(The document so identified was marked "Complainants' Exhibit No. 67.")

By Mr. Jackson:

Q. I ask you to turn to page 22 of Complainants' Exhibit No. 67, and ask you to explain the source and meaning of table No. 4.

A. In the statistical records maintained at the Soo there are various facts usually running from year to year, on about pages 14-15, that carried the data applicable to the indicated year.

Q. And from that data you computed the percentage growth of commerce during the period covered?

A. It was merely an abstraction or arithmetical deduction from the detail appearing in pages 14-15 in the statistical reports.

Q. In the second paragraph on page 22, below the table in question appears this sentence:

"For the last twenty years the average water rate had been less than 9/10 mill per ton mile."

Q. What was the course of your information upon that rate?

A. These statistical matters again, maintained at the Soo, which for the year appear, in each case of the particular year's pamphlet, on about page 2. As illustrated for the year 1925, the ten mile rate was estimated to be 1.08 mills. On the same page, for the year 1923, the ten mile rate for that year was estimated to be 1.1 mills. We then went back for the period referred to and averaged them.

Q. You further state: "The lowest rail rate on similar commodities has been no less than three mills per ton mile." What was the basis of your information for that statement?

A. In the preparation of this report and the purpose to brief the ton mile rail and lake relations, we secured from various sources the rail rate, and my recollection is, we could find now here that on the class of bulk with which we were concerned, could we uncover a rate of, I think, less than 3.41.

Q. Was your search extensive or prolonged?

A. It was just as extensive as we felt fitted the case. We had published tariffs and utilized, without my remembering details, practically every source that we could that would give us the bulk rate.

Q. From your study of the ton mile rates by land and water, what do you estimate to be annual saving from the use of water transportation on Lake Superior traffic?

A. I stated it there to be something like $120,000,000 per year.

Q. On what basis did you compute that?

A. We took various classes of commodities and attempted to find, with such agencies and sources as we had, what was the difference between the presumed rail rate from the mine to the source of consumption, in the one case, and the rail, lake, rail rate in the other, and from such calculation as were made respecting such commodities, we reached the conclusion that the saving was probably in excess of $120,000,000 for Lake Superior trade.

Q. Did you then make an estimate for the whole lake trade?

A. I did not make an estimate for the whole lake trade, but I roughed it to the extent stated in the last sentence in that paragraph.

Q. And what was that statement?

A. "It is thought to be a fair statement that as applicable to the lake trade * * * the economy exceeds $150,000,000."

The basis for that has been our conclusion from looking at it a great many times, bearing in mind that the single source of exact record of traffic in the lakes is the Soo, but working it out with the best judgment available, I reached the conclusion that the total lake bulk trade was about 130 per cent of that recorded at the Soo.

Q. And was that determination of that relationship from a study of the records?

A. Oh, yes.

Q. Referring to table 5 at the bottom of page 22 in this exhibit, what was the source of the data from which you compiled that table?

A. It is again in the statistical reports, or if, preceding the date of their publication, in the Soo records, illustrated by, perhaps reference to page 10.

By the Special Master:

Q. When you say in the statistical reports, will you indicate what statistical reports you have in mind?

A. Yes, those issued annually.

Q. That is, issued by whom?

A. By the Engineer Department, and headed as stated here: "Statistical Report of Lake Commerce passing through the Canals," etc.

Q. That is issued by the War Department?

A. Issued by the War Department; yes, sir.

Mr. Adcock. What year?

A. To get the information contained in table 5—table 5 goes back, as you see, to 1899. Therefore we use statistical reports as far back as published and then the Soo reports to get back to the year with which we start that table—1899.

By Mr. Jackson:

Q. Referring to the Soo records, or the statistical report of Lake Commerce Passing through the falls at St. Ste. Marie, to which you have referred for various years, the source of those tables is based upon the original records of the Soo, is it not?

A. Exactly.

Q. What do you find from the study from which you deduced table 5, with reference to the trend of building in lake vessels? Was it stationary or decreasing or increasing?

A. Obviously it was increasing rather rapidly from and after 1899, and jumping considerably through 1906 and 1907, and thereafter.

Q. And from your experience while you were stationed at the Soo, have you any opinion as to the cause for this increase?

A. The cause for the increase is doubtless improved channels justifying the construction of bigger and more economical carrying vessels.

Q. In your table it appears that for the year 1924 there were a smaller number of vessels carrying cargo, and, in the preceding column number of tons, a smaller number by 10,000 tons, than carried in 1919. Can you explain that?

A. That is stated to be due to the fact that between the two years there was a lowering of the depths in the channel to be traversed by those carriers, and that thus in the low water year—I mean the latter year—in the larger vessel was carrying less than the smaller vessel of the preceding year of better water.

Q. That is, the physical proportions of the vessels using the lakes in the latter year were equally as large or larger but the draft they could utilize was less.

A. Correct.

Mr. Adcock. Just a minute. I didn't get the first year that you mentioned. The last year was 1919, wasn't it?

Mr. Jackson. He spoke of the comparison between 1924 and 1919, in table No. 5.

Mr. Johnson. And what was the answer?

(The answer was read)

The Witness. I think if I may read my paragraph on page 23, at the top, it might help. "The reduction in the number of vessels burdened to 10,000 tons or more, shown for 1924, is due not to withdrawal from service, but to the fact or loss of carrying capacity on account of the deficiency of channel depths."

By Mr. Jackson:

Q. Will you read the next short paragraph there? It seems to be further explanatory of that.

A. "The effect of receding levels is observable in that the maximum cargo of the 1924 carrier was less by 1500 tons than that of the 1919 carrier, a vessel of something like 8 per cent smaller capacity. The vessel drafts in the two cases were 19'3" and 20'6", respectively.

Q. Colonel Markham, referring to the table at the middle of page 23, entitled "Percentage of Season when less than 20 foot drafts were employed through St. Mary's River, for 1921, 2 3 and 4," will you state the source of your information upon which you based that table?

A. We have at the Soo as an official record the draft of every boat of every day for each of these years. We merely in each case took the total number of navigation days and observed from our record when boats were drawing 20 feet or more or less, and then took the percentage of the days related to the total season when the draft could not be maintained at 20 feet.

Q. Referring to the table No. 7, page 24 of Complainants' Exhibit No. 67, will you please explain the source of your data for that table and the meaning of the table?

A. The basic matter related to that table is shown in this bunch of work sheets I have here. Without its use for the moment, I can explain what was done. Every boat in the lake trade was listed, its dimensions, and the facts carried out in tabular form. The records through the Soo were unearthed to the point of finding, with the number of cargoes for each boat, what it was carrying when it passed through the Soo at a draft of 19 feet. If that exact draft could not be found for a particular boat, the nearest draft to 19 feet was taken and additions or deductions were made to create its capacity as a *de facto* thing for a draft of 19 feet. The boats were separated into classes, based upon their registered tonnage.

Q. Colonel, did you find how many vessels navigating the lakes could utilize a draft of 21 feet or better?

A. We did.

Q. And how many vessels navigating the lakes at that time could utilize a draft of 21 feet or better?

Mr. Adcock. It seems to me, if your Honor please, that he ought to describe the vessels and how he reaches that conclusion first. It is asking for a conclusion of the witness.

By the Special Master:

Q. State how you reached your conclusion.

A. We divided all vessels of which we had record of passing the Soo into the several classes indicated by the table of registered tonnages; of 6,000 or over; 5,000 to 6,000; 4,000 to 5,000; 3,000 to 4,000; 2,000 to 3,000. We then reduced each vessel to its length between perpendicular and its molded depth. We then found for each class what was the average keel length and average molded depth for the class. We then assumed that a boat should have about a minimum of 7 feet of its molded depth when loaded to its maximum. We then took the loading capacity of a 19-foot draft for each boat, and aggregating for each class the average keel length, the average molded depth, and utilizing what is known as a block co-efficiency, we determined the displacement value of each class in the aggregate. In arriving at the further compilation of this table we began to throw out boats of 21, 22, 23, 24, that

could not load to those drafts, based upon the report of the molded depths. We thus finally built arithmetically the displacement value of the fleet for an inch of draft and, accordingly, for any multiple thereof. That addition per unit was thereupon compiled into the column indicative of the additional fleet capacity in tons per season of 28 loaded trips, with available drafts increased from 19 feet to the common loading.

Q. From your computation can you state the number of vessels navigating the Lakes that you found would be able to utilize a 21 foot draft?

A. I cannot state that from this table.

Q. I would like to direct your attention to the first column showing the number of vessels included in all classes.

A. Yes, sir.

Q. And I would like further to direct your attention to the column headed "1 feet draft," in the second part of the table, and to ask you whether from an analysis of those two columns you can answer the question?

A. The number of boats that we began to consider as indicative in the first column is 367.

Q. Now, comparing your column headed "20 feet draft" in the second part of the table with your column headed "21 feet draft" in the same part of the table, can you state whether you found that all of the vessels so listed in all of your classes could utilize the 21 feet draft or not?

A. Yes, sir. I get the point. The table shows that the increment for one foot, from 19 to 20, in other words, for the lower classes is 815,000 tons. It shows the increment for the same class of 22 feet, which is an increment of 2 feet, to be 1,630,000 tons, which is twice the number of tons indicated in the 20 foot column, and therefore indicates that all boats are included in the 21 foot draft.

Q. From that study, Colonel, and directing your attention to the second paragraph below the table which you have just been discussing on page 24 of Complainants' Exhibit No. 67, I will ask you whether you made any computation as to quantity of additional freight which could have been handled by the Lake fleets on Lake Superior with 6 inch additional draft?

A. Yes, sir; based upon the increment value, I will call it, of an inch for the total fleet as just explained by the average of these classes, and by the multiplication of six we found that the Lake Superior fleet in the year 1923 could have carried 3,346,000 more tons than were actually transported if each boat could have been drafted to an additional six inches.

Q. Did you make any estimate or computation for the whole of the lake commerce, as well as the Lake Superior traffic for 1923, on the basis of the increase of six inches of available draft for the lake fleet?

A. I assumed, as stated before, that the total lake bulk is about four-thirds that recorded at the Soo, and thus made the statement that the 3,346,000 tons accounted for on 6 inches for Superior trade, the total through business of the Lakes for that year, incident to the six inch difference of level, related to something in excess of four million tons.

Q. Colonel, I direct your attention to a paragraph at the bottom of page 24 and top of page 25 of Complainants' Exhibit No. 67, reading as follows:

"From the above outline of lake commerce, and of the number dimension, and capacity of the lake freighters doing its bulk business, two facts become evident: first, that the existing fleet could carry seasonally, on drafts for which designed, something like twenty-five to thirty million tons in excess of the cargo possible of transport by the same boats over the channel depths now available; second, that the loss of inches in channel depths due to receding levels or otherwise is a matter of large import with respect to shipping efficiency and to the transportation charges of the bulk commodities concerned. It would thus be a matter of not difficult resolution, to recommend that the connecting ways be deepened to provide for drafts of 20 feet below the improvement planes hereinbefore proposed as representative of low water stages. Actual accomplishment, however, involves contrary considerations which are believed to be controlling." Will you please explain first what you meant by the "improvement planes hereinbefore proposed" in that paragraph?

A. The law or the legislative item under which this preliminary report is being revised reads:

"Great Lakes from Duluth, Minnesota, to Buffalo, New York with a view to such improvement as may be required for a through channel suitable for vessels drawing 20 feet at lake stage corresponding to the Lake Huron level of 578.5 feet above mean sea level."

The channels have been about completed for a draft of 20 feet below Lake Huron improvement plane 579.6. The proposed new improvement plane differed from that just roughly about a foot and a tenth. I regarded it as ill-advised and inappropriate to attempt merely to lower it by that amount in order to provide merely for the continuance of a 20 foot draft. That for the reason I thought I saw plainly that from an investigation of all conditions in all regions the time and cost elements would be exorbitant in the removal of that thin layer.

By Mr. Adcock:

Q. Have you finished your answer?
A. I think so.

By Mr. Jackson:

Q. Referring to page 21 of Complainants' Exhibit No. 67, does that table show the proposed improvement or datum plane in the right hand column which you had under consideration?

A. It does.

Q. What was the reason for proposing the new datum planes which were lower than the ones then prevailing?

A. The Chief of Engineers fixed that basic figure at 578.5 because Lake Huron had then reached about that stage, and I think he presumed that Lake Huron would not be likely to go lower.

Q. Did it go lower?
A. Very much lower.

Q. So, as I understand you, your failure to recommend a 20 foot channel was not because such a draft would not be desirable and would not be utilized for a large commerce, but because of the relatively large expense for a small deepening?

A. Correct.

Q. I refer you to page 21 of Complainants' Exhibit No. 67, and direct your attention to this paragraph or sentence:

"It is thought to be utterly unsafe to assume that minimum lake stages have been reached, and particularly to assume an early return to normal levels. To the contrary, it is deemed to be imperative that the probability of low water, for perhaps an extended period be accepted, and that future recurrences of stages as low, or lower, than the present be contemplated. Accordingly, it is essential that new improvement planes be adopted for the service of shipping on 20 foot drafts, more safely in approximation of present low water."

That was then your opinion?

A. Yes, sir.

Q. Is it still your opinion?

A. Yes, sir.

Markham, Trans. 743-759.

Q. Do you think that lakes ought to be constructed to fit ships or ships to fit lakes?

A. I would answer that by saying that in my scrutiny of the history of the lakes it is obvious that the owner will build for the last inch of whatever depth the Government will provide, so that the ship will be made to fit the water.

Q. Does not that seem to indicate that he will build beyond what the Government will provide and then try to get the Government to provide more?

Mr. Baker. I object to that.

The Special Master. It is cross examination, Mr. Baker, and it will be allowed. It is testing the witness' opinion and process of reasoning.

A. It is my opinion that the ship owner has built to fit the third and fourth lock which the Government contemplated and built or authorized, I think, in 1907, with a still depth of 24½ feet. That to me has been the most obvious reason why ship-builders would build beyond the 20-foot draft. The two locks are there suggestive of the purpose ultimately to make the channels fit the locks that have been installed.

By Mr. Johnson:

Q. The construction of the lock is something to which a sort of hope could be pinned that the rest of the system would be built deep enough to comport with the lock?

A. I would say that the Government agencies probably anticipated that in time commercial channels would be put down to fit a 24½ foot still depth which was adopted.

Q. You referred to your table No. 5 on page 22 of your report and were asked to compare and did compare the number of vessels carrying 10,000 tons or over in 1919 with the number carrying 10,000 tons or over in 1924. How did 1919 compare with others of the past 35 years as to water depths in the lake?

A. Well, I would have to have a graph, of course, but it was a comparatively high water year. I merely recall that 1918 was a high water year. We began to lose water in 1918, but it was a comparatively high water year.

Q. Were not those years the highest years in the period?

A. I would not recall that, but it was a comparatively high water year.

Q. Referring to page 6 of the statistical report for 1925, the second table in the report, will you read the lines in the first two columns; that is, read the line across the first two columns. By that I mean the title column and the next colmun.

A. In the second table, sir?

Q. Yes.

A. The table is headed "Average and Maximum Dimensions and Percentages of Total Freight Carried by Vessels of Different Classes." The table is made up with heading seriatum from left to right, class, number of boats of class using canal, aggregate registered tonnage, average register.

Q. I just wanted you to read the first two.

A. Under the first column, "Class," we find tons net register between one and one thousand with the second column applicable to that register; number of boats of class using canal, and the number is 181. The second line of the first column is one thousand to two thousand net register, and the number thereof is 126. For two thou-

sand to three thousand the number is 80. For three thousand to four thousand the number is 137. For four thousand to five thousand the number is 89. For five thousand to six thousand the number is 77. For six thousand to seven thousand the number is 38. For seven thousand to over the number is 1. The total of the first column being the number of those boats, is 729.

Q. Are we entitled to deduce from that table that the bulk of this freight is carried in the boats with registered tonnage of 6,000 and under?

A. By all means.

Q. I should have said 5,000 and under.

A. I think I can turn you to a table that gives that exactly.

Q. All right. As a matter of fact, it is given in the next table.

A. Yes, the last column of Table 3 on page 6 answers that fully.

The Special Master. For the sake of the record, what is the answer?

A. The percentage of total freight carried by boats with net register of one to one thousand is 1 per cent; net register of one thousand to two thousand is 3 per cent; net register of two thousand to three thousand is 9 per cent; net register of three thousand to four thousand is 20 per cent; net register of four thousand to five thousand is 24 per cent; net register of five thousand to six thousand is 26 per cent; net register of six thousand to seven thousand is 16 per cent; and net register over seven thousand is 1 per cent.

Markham, Trans. 898-902.

Q. To what draft could your vessels load in the event that the water depths were sufficient to permit the maximum loading of your vessels for which designed?

A. Our largest vessels could load, so we are advised, from 23½ to 24 feet, if their drafts permitted it.

Q. Have you any vessel which could not load to 21 feet?

A. No, sir.

Q. What is the depth of the vessels in your fleet which could load to a maximum of 21 feet?

A. Twenty-eight feet.

Q. What allowance for freeboard is usual and customary in navigation on the lakes?

A. In my experience 7 feet.

Q. How is the depth to which the vessels of your fleet are currently loaded determined?

A. The maximum draft is determined by the recommendations of the Lake Carriers Association, posted at all loading ports.

Q. Do you give any instructions to your captains or sailing masters with respect to the depth of loading of the vessels of your fleet?

A. Our instructions to masters are to load not in excess of the recommended drafts of the Lake Carriers Association, but if, in their judgment, the recommended drafts are at any time excessive, to load to such draft as they consider safe.

Q. Mr. McGean, when the vessels of your fleet, of the type which you have described, are required to load one inch less deeply because of a lack of available drafts, to what extent, if any, does that affect the carrying capacity of one of your vessels?

A. Our experience is that the large ships of our fleet, when loading between 18 and 20 feet, lose approximately 80 to 90 tons per inch with each inch of reduction in water.

Q. And as to those of your vessels which are designed to load to drafts above 20 feet, what is the loss in carrying capacity with a loss of draft on one inch for those vessels between a draft of 20 feet and the maximum draft for which they are designed?

A. We have never had any experience in loading, as I recall it, beyond 21 feet or approximately 21 feet, so above that is theoretical, but we are advised by the folks who built the ships that when you get into drafts beyond 21 feet, the loss per inch would be many more and on big ships would run up to, perhaps, 100 tons, when it got above 21 feet.

McGean, Trans. 917-918.

Q. The point I am trying to get at, Mr. Schneider, is the differential intended to be equivalent to what you would receive for a full load, in the prevailing depth, if that harbor were able to take them? I do not know whether I make it clear or not.

A. Well, I do not know just what you mean. As I understand it, you want to know what actual rate we charge to a slow port, as against a full draft port—I mean a shallow port as against a full draft port. Is that what you mean?

Q. It was suggested by one of the witnesses yesterday that, in the case of a port of restricted draft, the differential was ordinarily intended to make up for the freight on the last load?

A. Yes, I think I stated that before.

Q. Well, I did not have it clearly in mind. What can you say with respect to the expense of unloading the additional amount of ore, or coal, or stone, which might be carried by an extra six inches of draft?

A. Well, there would not be any additional cost to the boat.

Q. Well?

A. So far as the unloading cost is concerned, I believe that is your question?

Q. Yes.

A. There would not be any for the ship.

Q. Well, what would be the additional cost to the person who was paying for the unloading?

A. Well, there would not be any additional cost to the man; he pays so much a ton for unloading. There would probably be a difference in cost to the dock, if that is what you mean.

A. Well, what difference of cost would there be to the dock?

A. Well, the more cargo a boat can carry, the less clean-up, in proportion to the cargo. And the clean-up is the most expensive and the slowest operation. So that the fuller the boat, the less clean-up in proportion and in the cost, correspondingly the less per ton.

Schneider, Trans. 1054-1056.

Q. Is there any rule that you have with reference to the relationship between draft and depth?

A. Only that we found from practical experience. We found that we should have a certain space, so much water between the bottom of the boat and the sweepings of the channel. We have established a fairly good basis for that. We find that when we exceed that we have more or less trouble with our boats, and we are liable to have damage, so we keep it within certain lines as close as we can.

Q. What are those lines

A. About .7 of a foot we allow in the West Neebish Channel.

Q. Captain, how does the Captain of a vessel, who is operating one of these freight-carriers, determine to what draft he will load this vessel?

A. At every loading port we have a bulletin and whenever we raise or lower it that bulletin is changed to correspond, and the Lake Carriers send out reports of the Shore Captains' decisions.

Q. Do Captains exceed that recommended draft?

A. No, sir. That is the maximum they are allowed to load. Very often they load to less.

Q. Are there any temporary or local fluctuations in the water levels of the lakes?

A. Quite a number.

Q. Please explain how the captain of a vessel, as a practical matter, takes care of that fluctuation in the navigation of his vessel.

A. Suppose you were going up Lake Erie and the Detroit River. We have a signal at the bar point, an arrow that gives you automatically the amount of water through the dredged channel. That is automatically operated. Coming down the Detroit River, right below Detroit where you go into the Livingston Channel, we have another that is not operated automatically, but the signal is an arrow, and if the water is going up that points upward. At night there is a light behind it so it will show at night time the exact amount of water it is safe to go with over the Livingston Channel. If we haven't suffi-

cient water we will anchor until that signal is changed and we have sufficient water to go over. At the Soo Locks they have reports from down the river just what water, that the draft of water is, and he stops at the Soo Locks if the water is not sufficient for him to go over in safety.

Q. To what draft are your vessels designed, Captain, the vessels of your fleet?

A. Well, as we have loaded them—this has been our practical expecience; of course, our latest vessels we have never loaded to their maximum depth. There are some boats that we have loaded down to 21 feet. And we have no smaller boats than those having a 28-foot molded depth; that is, from the bottom to the top of the boat. And we have loaded those to 21 feet. Now the majority of those smaller boats that are not over what we call the 400 foot class, I think that is sufficient draft for them. Our larger boats have a molded depth of 32 feet, and there is no doubt in my mind—while I have not loaded them—there is no doubt in my mind that we can load that to a safe draft of 24 feet.

Q. Well, are your vessels, in the practical operation of your fleet, loaded to utilize each inch of the draft which has been recommended?

A. Of course, we do if we can, but we do not put any restrictions on the captain to make him load to that draft. He has to exercise his own judgment, but he is not to exceed that. If he thinks that is too much in the fall of the year, he is authorized to cut it down.

Wood, Trans. 945-949.

UNITED STATES SHIPPING BOARD,
Washington.

No. 1176.

For Release in morning papers of Monday, November 29, 1926.

The magnitude of water-borne traffic on the Great Lakes is shown in statements prepared by the Bureau of Research, United States Shipping Board, in cooperation

with the Board of Engineers for Rivers and Harbors, War Department, indicating that more than 210,300,000 cargo tons of freight were handled through Great Lake ports in 1925, an increase of 31,000,000 tons, 11.8%, over the total of the preceding year. Nearly 44% of the total water-borne commerce of the United States was conducted on the waters of the Great Lakes. The 197,500,000 tons of coastwise commerce of Great Lakes ports exceeded the total coastwise trade of ocean ports by more than 30,000,000 cargo tons, and the 12,800,000 tons of foreign commerce passing through Great Lakes ports constituted 13.8% of the total foreign commerce of the United States in 1925.

In the relative standing of all United States ports by volume of cargo tonnage handled, Duluth-Superior, with a total of 45,600,000 tons, ranks second to New York. Fifteen other Great Lakes ports handled more than 5,000,000 tons of freight each. The total cargo tonnage passing through these sixteen ports exceeded 172,900,000 tons and included 82.4% of the coastwise traffic as well as 78.3% of the United States foreign trade conducted on the Great Lakes in 1925.

The 1925 foreign and coastwise trade of these sixteen leading ports was as follows:

	Total	*Foreign*	*Coastwise*
Duluth-Superior	45,604,323	841,639	44,762,684
Buffalo, N. Y.	15,917,489	5,092,259	10,825,230
Toledo, Ohio	14,171,694	1,318,789	12,852,905
Calumet, Ill.	10,831,051	.....	10,831,051
Cleveland, Ohio	10,803,443	426,406	10,377,037
Conneaut, Ohio	9,639,901	91,445	9,548,456
Ashtabula, Ohio	8,800,420	356,605	8,443,815
Calcite, Mich.	7,590,859	31,339	7,559,520
Ashland, Wis.	7,356,764	253,593	7,103,171
Agate Bay, Minn. ...	6,199,549	.....	6,199,549
Detroit	6,148,033	5,935	6,142,098
Lorain, Ohio	6,088,682	188,024	5,900,658
Milwaukee, Wis.	6,061,033	90,199	5,970,834
Escanaba, Mich.	6,060,431	175,381	5,885,050
Gary, Ind.	6,035,714	.....	6,035,714
Sandusky, Ohio	5,601,085	1,163,133	4,437,952
TOTAL	172,910,471	10,034,747	162,875,724

Exhibit 144.

Q. Can you make any comparison between the total lake tonnage and the total of the railroads of the United States?

A. The last published statistical report of the Interstate Commerce Commission shows that the railroads of the United States, generally known as Class 1 Roads, carried in 1924, 1,187,295,744 tons. That is the amount of freight which the railroads originated. In 1924 the total tons of the Great Lake Commerce amounted to 101,493,084 tons, or the lake commerce amounted to 8.6 per cent of the total railroad traffic of the United States.

By the Special Master:

Q. You say an amount equal to.

A. Equal or equivalent to, yes. In ton mileages the comparison is more striking. The ton mileage of the rail-

roads is given in the reports of the Interstate Commerce Commission and the ton mileage carried on the Great Lakes is given on page 1 of this exhibit, and the ton mileage of the Great Lakes amounts to 18¼ per cent of the ton mileage of the railroads carried, or an amount equivalent to 12.25 per cent of the total railroad ton mileage of the country. I made another comparison to show the amount of business on the Great Lakes as compared with the railroads and found that for 1924 the amount of ton miles produced Great Lakes commerce was substantially the same as the ton miles of freight carried by the Pennsylvania Railroad, the New York Central and the Baltimore & Ohio.

Q. Of the three railroads combined?

A. Of the three railroads combined.

By the Special Master:

Q. You mean their system?

A. Their system.

By Mr. Jackson:

Q. Have you got the years, other than 1924, for comparison of the lakes commerce and the railroads?

A. I have not. I took 1924 because that was the last year I could get for the railroads.

Trumbower, Trans. 1232-1233.

In these years lake levels were high and the vessels were able to load to a draft of 21 feet or more. In 1924, however, due to lower lake levels, the vessels were never loaded to a draft exceeding 19 feet. With the loss of every inch of draft below 20 feet, the modern lake bulk freighter suffers a loss of from 90 to 100 tons in cargo capacity. It will gain a corresponding amount for every inch of draft in excess of 20 feet.

Exhibit 95, page 36.

"Transportation on the Great Lakes," by War Department and U. S. Shipping Board.

Considered both from the standpoint of their area and the extent of their commerce, the Great Lakes with their connecting channels constitute the most important body of fresh water in the world. They afford access to regions notable for the magnitude of their natural and industrial resources. They permit the grain of the western prairies and the Canadian Provinces to reach eastern mills and ports of export at substantial savings, compared with all-rail routes.

During the last few years, however, the depths have been much below normal, due in large measure to a periodic recurrence of low water conditions, and to some extent to artificial diversions of water.

Exhibit 95, page 418.

"Transportation on the Great Lakes," by War Department and U. S. Shipping Board.

The importance of the grain territory tributary to the Great Lakes, is shown by the fact that during the 10-year period ending with 1923, the States in this territory produced 71.8 per cent of the wheat, 78.7 per cent of the oats, 66.8 per cent of the corn, 73.1 per cent of the barley and 83.2 per cent of the rye of the United States.

Exhibit 95, page 420.

"Transportation on the Great Lakes," by War Department and U. S. Shipping Board.

In the above mentioned report entitled "Transportation on the Great Lakes" (p. 36) it is said: "With the loss of every inch of draft below 20 feet, the modern lake bulk freighter suffers a loss of from 90 to 100 tons in cargo capacity. It will gain a corresponding amount for every inch of draft in excess of 20 feet." There are critical points of navigation, e. g., in the St. Mary's River, the St. Clair River, Lake St. Clair and the Detroit River and vessels are loaded with respect to available depths at such

points. While they are quite definitely established routes or lanes for vessels plying between the various ports on the Great Lakes, vessels deviate from such courses in bad weather, both because of the difficulty of maintaining the course with precision under such conditions, and because of the necessity of seeking protection under weather shores. At such times, when the vessel is of necessity off the regular steamer track, a lowering of the level of the lakes increases the hazards and dangers of navigation, contributing to groundings or strandings.

The defendants point to other diversions and artificial changes in the Great Lakes and connecting channels, which have contributed to this total lowering of levels. It is evident, however, that during a period in which the level of the Great Lakes is being lowered, an additional lowering, even of six inches, would be even more serious in its consequence than if it occurred at a time when other causes did not operate to lower the levels of the lakes or operated to raise them.

These are not actions for damages, and it is not necessary to attempt to estimate with precision the extent of the damage caused by a lowering of six inches in lake levels. The defendants have introduced evidence for the purpose of showing that the claims of damage have been exaggerated, but after considering the testimony and critical analyses presented by the defendants, I am satisfied that the evidence requires the finding that the lowering of lake levels of approximately six inches has had a substantial and injurious effect upon the carrying capacity of vessels, and has deprived navigation and commercial interests of the facilities which otherwise they would have enjoyed in commerce on the Great Lakes.

Special Master's Report, pp. 115-116.

8. That if, within six months after the issuance of this permit, the City of Chicago does not adopt a program for metering at least ninety per cent of its water service and provide for the execution of said program at the aver-

age rate of ten per cent per annum, thereafter, this permit may be revoked without notice.

Exhibit 12, Doc. 45, Trans. 435.

Permit of March 3, 1925.

Since the close of the hearing before the Special Master and the final submission of this case to him on June 3, 1927, the City of Chicago, acting through its duly elected officers, has refused to further carry out condition No. 8 of the permit of March 3, 1925, by refusing to install further meters to measure the domestic water supply of the city and by refusing to further read meters theretofore installed under the provisions of the ordinances of the City of Chicago passed pursuant to the requirements of condition No. 8 of said permit. Obviously these facts cannot appear in the record of the testimony taken before the Special Master, but complainants are confident that the defendants will not deny the truth of these facts.

APPENDIX "I."

Q. Would a change or reduction in diversion require any alteration of design in your lock at Lockport?

A. No, it would not, because the lock is done.

Q. Well, it would not require any alteration for the purpose of obtaining a 9-foot channel, as far as the lock is concerned?

A. Well, the law does not fix the channel at 9 feet.

Q. I understand that the law does not fix the channel at 9 feet.

A. It fixes it at 14 feet.

Q. But we are talking now about a 9-foot channel, Mr. Barnes, and I wish you would answer my question on the assumption I have made.

A. I cannot answer on the assumption you have made, because there is no such thing as a 9-foot channel in the lock. The law specifies it shall be 14 feet.

Q. Then, in short, without a diversion the lock as designed, and without any change, would be more than ample to take care of traffic which was limited by the controlling depth of a 9-foot channel; is that true?

A. It is true without any diversion, but it is not a question of—

Q. I just want to get at one thing at a time.

Barnes, Trans, 6806-6808.

Q. Mr. Barnes, if the quantity of water diverted at Chicago were reduced to a thousand second feet, the only effect that would obtain upon the construction of the Illinois waterway would be on the question of the excavation of the channel between those locks, would it not?

A. No.

Q. What additional factor would be involved, if any?

A. There would be the additional depth it is necessary to go in the location of the locks and the design of the locks, the depth on the bottom of the sills.

Q. You have just told me that as the locks are now designed, they would provide for all traffic over a waterway having a controlling depth of 9 feet.

A. But, mind you, we must make those locks 14 feet.

Q. But we will confine ourselves for the time to 9 feet, and assuming a waterway of 9 feet, would there be any effect by way of the reduction of the Chicago diversion to 1,000 second feet other than the question of possible additional excavation in the channels between these various locks and dams?

A. Nothing between the locks and dams; but I must insist that those locks must be made lower; that is, we must go lower in order to comply with the law of the state.

Q. Mr. Barnes, I would like to insist that we leave aside the legal questions that you may or may not have involved in your state, and have you answer my question as to whether or not with a diversion reduced to a thousand second feet a 9-foot waterway might be obtained in this stretch which is shown upon your exhibit 1194, without any further change other than possibly additional excavation in the channels between the locks.

A. That is true for a 9-foot waterway.

Q. That is the answer I have been trying to elicit or at least to find out what the fact was.

A. That only thing I am trying to say is that I cannot build a waterway based on the present plans because I cannot comply with the State laws and so do.

Q. But you could build it so that a boat drawing 9 feet could still get through?

A. You can do most anything, if you want to do it illegally.

Q. Illinois would not want to do anything illegal, of course, or Chicago, I understand that. Now, Mr. Barnes, are you able to tell me just what difference it would make in excavation between the Lockport lock and the Brandon Road lock to obtain a 9-foot channel with a reduction of the diversion to a thousand second feet?

A. I cannot tell you definitely, because no accurate surveys have been made. The best estimate I can make is that there is between 8 and 9 feet of water on the rock cliff noted on these plans between those two locks. If the diversion is cut to 1,000 second feet the slope will be so

far reduced that I am very confident that a part of that rock cliff, which is about two miles, or a little less than two miles in length, must be removed. That is solid limestone rock and it probably would cost from four to six and possibly eight dollars a yard to remove it, for the amount necessary.

Barnes, Trans. 6812-6814.

Q. Mr. Barnes, will you tell me what is the slope of the section between the foot of the lock and dam at Lockport and the one on Brandon Road with a flow of 10,000 second feet?

A. I cannot do it from memory. I am not so sure that it is shown in the plans with sufficient detail so that you can determine definitely.

Q. Can you tell me the slope in any of the pools of the Illinois waterway with a flow of 10,000 second feet?

A. Not from memory, no.

Q. Have you any design which you have prepared that you can produce for us?

A. No design, no, sir.

Q. So there is nothing in existence in your office which would show what these slopes would be?

A. There is an estimate, but no design.

Q. Nor for any other flow through those channels?

A. The 6,000 in the long pool is shown in the plans approved by the Secretary of War.

Q. That is, from these plans attached to Exhibit 1194 the slope for a 6,000 second feet flow at the pools is shown?

A. In the long pool. In the other pools the slope is so slight that I do not think you can tell very definitely what it is.

Q. That is, the long pool is the one between the Dresden Island Lock and the Marseilles Lock and dam. Is that correct?

A. Yes, sir.

Q. The other pools are so short that it would be very difficult to determine any change in slope. Is that the situation?

A. Not quite that. The scale is so small there that you cannot tell definitely what it is. It would take a detailed map to determine definitely what that slope is.

Q. It would be very small in those pools, I presume?

A. The first or the lower pool is not very small. I remember that the slope there is sufficient so that if the discharge is lowered materially there is considerable rock and shale excavation at the upper end of the pool.

Q. Which pool are you referring to?

A. The lower pool.

Q. The long pool?

A. No, sir; the lower pool. And above the long pool there is some considerable slope which requires, if the discharge is reduced, some excavation above and below Lake Joliet. In fact, I think some excavation is required in Lake Joliet itself.

Q. Mr. Barnes, have you the height of the water below the dam at Lockport with the 10,000 second foot flow?

A. It is a matter of record, of course, in our office or in the Sanitary office, and it can be obtained. I do not have it with me.

Q. Is it 14 feet above the elevation of the sills of the lock?

A. I do not remember. As I testified yesterday, I do not remember exactly what it is, but it is at least 14 feet.

Q. Fourteen feet or better?

A. Yes, sir.

Q. Would that be true below each of the locks?

A. Yes, sir. It is at least 14 feet, but it is undoubtedly more than 14 feet.

Barnes, Trans. 6982-6984.

Q. Does or does not the amount of diversion of water from Lake Michigan through the Sanitary and Ship Canal or through the Illinois and Michigan Canal have any bearing upon the cost of construction or upon the navigable capacity of the Illinois waterway?

A. I think it has.

Q. In what way and to what extent?

A. As the amount of water from Lake Michigan is increased, the cost of excavating and forming the channel decreases. Also, the structures must be modified in accordance with the amount of water obtainable from Lake Michigan. Based on a flow of 10,000 cubic feet of water from Lake Michigan, the extra cost for channel only, if the diversion were decreased to 1,000 cubic feet per second, I estimate to be about $1,400,000.

Q. Let me see if I understand you. That is the difference between cost of construction of what?

A. Between a flow of 10,000 and a flow of 1,000. That is the increase in cost.

Q. How much?

A. About $1,400,000.

Barnes, Trans. 5644.

APPENDIX "J."

Q. General, is there any addition to the natural flow of the Illinois River necessary for its improvement for a 9-foot channel?

A. If the 9-foot channel is secured by locks and dams, there is no need of any extra water.

Q. How many locks and dams would that require in that section of the river?

A. The improvement of the river for a navigation of 9 feet, under the existing circumstances, can not be properly secured until there is a dam in the Mississippi River below the mouth of the Illinois, such as was estimated for by the 14-foot waterway board, from Lockport to St. Louis. They found that they would have to put a dam in the Mississippi River, down in the neighborhood of Alton, to back the river up, the Mississippi, high enough to get sufficient depth at the outlet of the Illinois River, so that boats could get out of the Illinois River into the Mississippi River, and then from above this dam at Alton down to St. Louis, by a canal.

Q. General, has the Corps of Engineers of the War Department ever recommended a greater depth of improvement for the Illinois River than 9 feet?

A. They have never recommended anything higher than 9 feet. They have been called on time and time again for estimates of cost for securing 14 feet in the Mississippi, between Cairo and St. Louis; in the Illinois between Grafton and Chicago; in the Mississippi and the Illinois between St. Louis and Chicago; but in the report, from Lockport to St. Louis, the 14-foot Waterway Board, of which General Ernst was chairman—the estimates were according to the orders of Congress, to determine what it would cost to have 14 feet, and how they could get 14 feet. But the report, when it was submitted, was transmitted to Congress by General Mackenzie, then Chief of Engineers, December 12, 1905, with a report ending up this way:

"No opinion is expressed in this report as to the possibility of undertaking the project. Such opinion is not called for in the act ordering the survey."

It never has been recommended.

Q. Is there any season of the year during which navigation is closed on the Illinois River?

A. Several of the reports intimate that navigation will be closed for perhaps three months during the winter on account of ice; and the Mississippi itself has sometimes been closed and navigation stopped by ice, even as far down as Cairo.

Q. Perhaps you will answer this question. In your opinion is any other method of navigation than by locks and dams possible for the section of the Des Plaines River from Lockport to Utica?

A. It is possible to make a depth of water from Lockport to Utica of a greater draft, if you get water enough to turn into it, but it would not be a navigation route that would be safe for any vessel to navigate. The great trouble with that portion of the Illinois River is that at low water you have not enough for open navigation and when the floods come along they are so great, so large, that it is very dangerous because they rise so high and the currents are so swift.

Q. You are now referring to this deep section of the river from Lockport to Utica?

A. Yes.

Q. That is principally the Des Plaines River?

A. That is the Des Plaines River, part of it. From Lockport down to Kankakee is the Des Plaines and from Kankakee down to Utica is the Illinois, and that section would be dangerous for navigators in high water.

Q. In your opinion how much lockage of water would be necessary to operate a 9-foot channel from Lockport to Utica?

A. The channel from Lockport to Utica being slack water navigation, lock and dam navigation, you only need enough water to keep the pools full, and the pools will stay full, except for evaporation unless boats are passed through the locks; so that all that is necessary is to furnish water enough for the lock passage of the boats through the locks, to furnish lockage water plus a very small amount to cover evaporation.

Q. In your opinion how much would that lockage water be?

A. The board that was called on by Congress to report on this route from Lockport to Utica--

The Special Master. You were asked for your opinion, General.

A. My opinion?

The Special Master. Yes.

A. From 500 to 1000 feet per second will furnish all the lockage water that is necessary for about 60,000,000 tons a year down the river.

Q. Of course during the closed season of navigation no lockage water would be required.

A. None is needed during the closed season of navigation for navigation purposes, and, therefore, none for locking purposes.

Q. Is there any source of supply for this lockage water other than Lake Michigan?

A. The Illinois River and its tributaries carry a lot of water. I refer now to the geological copy of water supply papers from 1916 to 1925, in which they give the mean monthly flow and the minimums that have happened and the maximums that have happened on a great many tributaries and on the main river. In the tributaries of the Illinois River, the Des Plaines itself at Lamond, which is above Lockport, averages 390 second-feet each year from 1916 to 1925. The Kankakee averages 3500 second-feet from 1916 to 1925. Those are monthly means. The Fox River which is a tributary to the Des Plaines—well, it is one of the upper tributaries of the Illinois—averages 1201 second-feet. The Fox and the Kankakee were both mentioned in some of the past reports as places from which water could be secured for the locks in the upper river. The upper Fox River is parallel to the Des Plaines, both of them rising up in Wisconsin, and running fairly parallel to each other—not very far apart. The Fox River at Algonquin, Illinois, which is up 150 feet above Lake Michigan at that point, has a monthly mean flow of 169 feet per second, with a maximum of 4000. It will be possible to take water from the

upper Fox and run it over into the Des Plaines. Algonquin is about 40 miles away from the canal, but it is only about ten miles away from the Des Plaines—up in that neighborhood at Antioch. The Kankakee River at Momence, which is pretty near the dividing line between Illinois and Indiana, where it is 32 feet above Lake Michigan, and about twenty miles away from the head of the old feeder canal from the Calumet into the summit level, has a monthly mean of 1628 feet per second and a minimum of 432 and a monthly maximum of 5632. The head waters from Kankakee up from Momence are pretty near the marshes up the Kankakee, and not very much different in level from the neighborhood of the Little Calument. It ought to be fairly easy to get some communication from the upper Kankakee over to the Blue River portion which was the end of the Calumet feeder, so that water could be run over into the summit level. Both of them might be used as feeders. I doubt whether the matter ever was investigated, because of the fact that it was so much simpler to take the water out of Lake Michigan, but these figures that I give are the monthly minimum, as quoted from the geological supply papers, and they are the lowest amount that ever flowed for a single day in any single month of the year; so that with the Fox at Algonquin, which has a monthly minimum of 168, it means that in the whole of those ten years, from 1916 to 1925, there never was but one day that the water got down as low as 169 second-feet, and the monthly mean of 860 gives you an idea of what the average flow was.

With the Des Plaines at Lamond the monthly minimum which is 18 second-feet, means that that is the average of the lowest flow of a single day in each one of those years. In some years there were times when there was no flow and other times when 152 feet was the lowest flow of any month in the year, but a monthly mean of 398 feet per second shows what the upper Des Plaines could do, and three hundred and ninety-eight second feet mean would be enough to carry about fifty million tons a year of locks ages. That region in the upper Des Plaines is a region of lakes. There are a lot of lakes up there and it might

possibly be found that some of those lakes could be used as reservoirs, so that the monthly mean could be converted into a gentle flow throughout the whole year. Then there are other ways of getting water which of course, are, some of them, more expensive.

Q. Let me ask you one question there, if I may. These rivers which you have described are all in the State of Illinois?

A. All in the State of Illinois.

Q. And are all of these rivers or some point on them of sufficient elevation so that the water could be transferred by feeders for use as lockage water in this canal?

A. I have said that the Fox at Algonquin was 150 feet above Lake Michigan, and the Des Plaines at Lamond was 3.9 feet above Lake Michigan, and right near the canal. The Kankakee is 32 feet above Lake Michigan, so that it would be possible to have water from either one of them transferred over to the Illinois, over to the summit level of the canal.

Q. So those rivers all naturally flow into the Mississippi Basin?

A. They all naturally flow into the Illinois.

Q. The Illinois River?

A. The Illinois River; consequently, the Mississippi Basin.

Q. Are there any other feasible methods of reducing the amount of water needed for lockage?

A. There are quite a number. For instance, in the barge canal in New York, at Little Falls, they have a very high lift of lock, and they have put in what they call a saving basin, so that after the water entering the lockage is run off into a side basin they use it the next time the lock is full.

Over on the Trent River in Canada they have two high locks, one 65 foot lift that is a pneumatic lift. They take 400-ton boats up and down there and only use about 25 feet per second of water throughout the whole year for a large tonnage. So the boats pass equally in two directions and do not use any water, except just enough to operate the movement of the boat floating.

In some places over in Europe they operate them by electricity and do not use any water at all. If the loaded boats are going down stream they keep pumping water. Every time a boat goes down they pump water into the upper level. If the boat is going upstream it is the other way and very little water is used. But if it is balanced there is no water used at all, practically. They have hydraulic lift locks.

The same is done in other places in England where they have high lifts by inclines. Boats running through there run by inclined railway. The Manchester Canal, a big ship canal, the upper lock for ocean vessels is a 25-foot lift. They have to get their water from the drainage right around the city of Manchester. They found they were short of water to fill the summit level, so they put in these saving basins, and after they had been in a few years they found they were something of a nuisance to them, although they were saving water, and so they installed pumps and they pumped the water by electric power from the lower level into the upper level to fill the summit level. I saw that at Manchester, and Mr. Cooley told the House Committee at one of his last appearances before them, that he had been at Manchester and had seen that arrangement where they pumped the water from the low level up into the summit level. So that there are several ways of getting water except running it on a large scale.

Bixby, Tran. 2113-23.

Q. As I understand it, General, you believe it would be possible to provide water for lockage in a canal or waterway from Lockport to Utica without diverting any water from Lake Michigan. Is that correct?

A. It would be possible; yes. It would be costly, naturally, but it is possible. There is another feature about it.

Q. That is, you could pump the water up to the summit level?

A. You could follow the example at Manchester.

Q. Or you could dam up the headwaters of the Fox River or the Des Plaines and divert water that way?

A. Yes, sir. Fox River has a lot of lakes at its head, so that it would not have to be dammed very much. It could be taken out of the lakes.

Q. You would have enough water to dam up or conserve some way so as to take care of the low water flow of those rivers?

A. The geological water supply shows they have plenty of water up there, if you could take it.

Bixby, Trans. 2127-28.

Q. The total capacity of a canal is not affected particularly by the number of locks, is it?

A. If there are no locks the capacity of the canal is dependent upon the capacity of the channel. As soon as locks are interposed, then the capacity of the canal is fixed by the capacity of the locks.

Q. Assuming that you have one lock in this channel: the ultimate capacity of the channel would not be decreased by the addition of two more locks?

A. It might be; yes.

Q. It would take a vessel just as long to go through one lock as the other, would it not?

A. Yes, but there might be delays at one lock and none at the other.

Those questions are very difficult to explain, but it is a fact that the interposition of a lock delays navigation, and the greater the number of locks the greater the delays.

Q. Mr. Barnes, when you said it was impossible to operate the Illinois waterway without diversion, you meant that it was impossible to operate the locks without water from some source. Is that true?

A. The only source that I concede that there is water available for the summit level is the Lake Michigan water, and therefore we would have to have diversion.

Q. Mr. Barnes, why could you not pump water from the mouth of the Kankakee?

A. There is not enough.

Q. You can pump it back again, can you not, each time?

A. We could if there was enough water there and you wanted to pay that expense.

Q. Do you mean to say that there is not enough water to fill the pool?

A. I mean to say that there is not enough water in the Kankakee River to supply the summit level, whether you pump it or divert it.

Q. You could pump it from the Kankakee and the mouths of the other tributaries that come in at that place, could you not, or near there?

A. There is no other there of any consequence.

Q. It would not be very expensive to pump water, would it?

A. Indeed, it would; it would be very expensive, both the first cost and the operation.

Q. Is it not a fact that you could pump lockage water from the Kankakee on an assumed tonnage of 30,000,000 tons a year, at a cost of one-sixth of a mill per ton per mile?

A. I do not know.

Q. As a matter of fact, you never made any computations to see what the cost of pumping the water would be?

A. I never made a computation on that basis; no.

Q. You stated that the only way that you could get water would be from the Fox River by a tunnel with a capacity of 2,000 second feet and with an available water supply of 100 second feet. Why did you propose to build a tunnel with a capacity of 2,000 second feet if all of the available capacity was 100 second feet?

A. Because the water that we can obtain from the Fox River must be obtained at flood time when there is a flow in excess of a thousand second feet; and if we must go to that stream for water we must take the flood flow of the stream, or a portion of the flood flow of the stream, which I have assumed to be 2,000 second feet for this purpose. If we want to take a greater flow of the stream we would have to build a larger tunnel.

Q. You also stated that when taking water from the Kankakee, which you stated could be done, you would pro-

pose to construct a tunnel at large cost that would have a capacity of 3,000 second feet. Is that it?

A I do not remember what it was. It is in the record. It was either 2,000 or 3,000. I think it was 3,000.

Q. And that the available water supply would be 90 second feet?

A. For the same reason that you must construct your tunnel large enough to take the flood flow.

Q. Mr. Barnes, what would be your purpose in taking 3,000 second feet at any season of the year, when it was much more than you would need for lockage water?

A. Well, you have to store it up in the lake in order to take it out again.

Q. You were proposing to carry this water by tunnel into Lake Michigan?

A. Yes, sir.

Q. And not just to the summit level?

A. Well, that is the summit level. Lake Michigan is the summit level.

Q. But, you were not going to carry it to the pool at Lockport, but you were going to carry it clear out to Lake Michigan?

A. The cheapest way would be to put it into Lake Michigan, and then take the water from Lake Michigan as required.

Q. Would it not be much cheaper to pump this water than to construct these tunnels that you have suggested?

A. I do not know. I have not gone into that, and you could not pump the flood waters. If you put down pumps you would probably pump the water as it was required for lockage purposes.

Q. It is perfectly feasible to install pumps and pump it into the pool and then pump it from one pool to the other as it is required for lockage, is it not?

A. Oh, it is feasible, of course. It is not the economical thing to do.

Q. You mean by that, that it is very expensive to pump water?

A. I do, yes.

Q. What?

A. Yes. It is very expensive.

Q. Can you tell me what it costs the city of Chicago to pump water, per million gallons?

A. Not definitely. My recollection is it is about 6 cents a thousand gallons, but I would not say definitely. I would not want to go on record as saying what the cost was.

Q. You would not care to make an estimate of what the cost of pumping this water would be?

A. Well, I should say, based on the city's experience, that it is about six cents a thousand gallons. That is running in my mind as what their cost is. I may be wrong about that.

Q. Assuming we need lockage water of a thousand second feet, how much would it cost to pump a thousand second feet?

A. If my computation is right, it would be about $450 per second.

Q. Per second foot?

A. No. Per second.

Q. I do not quite understand the term.

A. You asked me how much it would cost to pump a thousand cubic feet per second?

Q. Yes.

A. One thousand cubic feet per second is 7½ thousand gallons. At 6 cents a thousand—I beg your pardon—that would be 45 cents per second.

Q. 45 cents per second?

A. Yes.

Q. And then, to get the cost per day, you would have to multiply that by the number of seconds in a day? Do I understand you correctly?

A. Yes.

Q. Do you not know that 6 cents is altogether an exorbitant figure for pumping?

A. I do not know, no, sir. I am taking from—

Q. Really, you are not competent to make any estimate of the cost of pumping, are you?

A. I am competent to make an estimate, but I am not competent here on the stand to state what that estimate is, now.

Q. Well, I mean, presently you are not able to make any estimate?

A. No.

Q. —That you would wish to support?

A. No.

Q. With respect to the reasonableness of the cost of pumpage, will you state what, in your opinion, would be an outside figure for the expense of lockage water for the Illinois waterway, which you would consider reasonable?

A. Not without going into a computation. It would be of little value to make a guess on anything of that kind.

Q. You could state what, in your opinion, the expenditure or cost for lockage water, this waterway could stand, economically, could you not?

A. How much the waterway can stand, is of course, a matter of opinion. Every expense put on to the waterway is an expense that must be absorbed in the freight rates. If the expense becomes excessive, it means that the waterway is not feasible. What this pumping cost is, I could not state now, without a computation.

Q. Assuming the pumpage cost was $450,000 a year for lockage water, would you consider that that rendered the waterway not feasible?

A. $450,000 a year?

Q. Yes.

A. Well, that is capitalization of $11,250,000 at 4 per cent. That is a pretty heavy capital cost to put on a waterway of this kind. In studying the situation in 1921 and 1922, Colonel Judson said that it was not within reason—

Q. I do not want you to give any one else's opinion.

A. I am trying to state this whole situation.

The Special Master. Yes, but you are asked for your opinion.

The Witness. My opinion is that that is an unreasonable cost to place upon commerce, for an unreasonable method of getting water.

By Mr. Jackson:

Q. If that were the estimated cost of lockage water, and we assume a total tonnage, which you heretofore as-

sumed of 30,000,000 tons a year, it would be probably about one-sixth of one mill per ton mile, would it not?

A. That would be practically a mill per ton mile. That is capital cost.

Q. Did you figure on the tonnage going over the whole waterway or only a part of it?

A. I figured on the tonnage going 400 miles.

Q. It would be one mill?

A. Capital cost would be about one mill.

Q. I do not want capital cost. I want to know what the actual cost per year would be.

A. Well, actual cost per year is a different matter.

Q. The cost per ton mile.

A. If the cost to the public is $450,000, and the ton miles is 30,000,000 times 400 miles, the cost, as I make it here, is about four one-hundredths of a mill.

Q. Four one-hundredths of a mill per ton mile?

A. Yes, unless I have made some mistake in my calculations.

Q. That would be the increased cost of transportation, under the assumed fact?

A. No. Under the assumed conditions.

Q. Now, Mr. Barnes, is it your opinion that the Illinois waterway is not of sufficient economic service to be justified, if you had to pay four one-hundredths of a mill per ton mile for lockage water?

A. Four one-hundredths of a mill per ton mile is a pretty small item.

Q. Then, if you assume one-sixth of a mill per ton mile, would your answer be the same?

A. One-sixth of a mill per ton mile is quite a large item in the transportation of freight on waterways. The total cost of transportation on the Great Lakes is only about six times that.

Q. It is much more on inland rivers, is it not?

A. On the river from your own State, it is only about a mill and a half per ton mile.

Q. Is that the Fox River?

A. Yes.

Q. Is it your opinion that the addition of a cost of transportation of one-sixth of a mill per ton mile or four one-hundreths of a mill per ton mile would render it impossible for the Illinois waterway to compete with railways and to render any economic service, justifying its construction?

A. One-sixth of a mill per ton mile might be sufficient to discourage the use of the canal for the cheaper commodities. For the higher priced commodities it probably would not discourage them.

Q. Would the answer be the same for four one-hundredths of a mill per ton mile?

A. Of course, that is much less.

Q. Would the answer be different then?

A. No.

Q. It would be the same?

A. Yes. Of course, the effect of four one-hundredths is much less than the effect of one-sixth of a mill.

Q. The average railroad rate is one and one-half cents per ton mile, is it not?

A. No, sir.

Q. Is it 1.1 cents per ton mile, or do you know anything about it?

A. I am inclined to think it is a little greater than that, on the average for the country, but, it is not far from that, but that is not on low-priced commodities.

Tr. Barnes, pp. 7098-7110.

APPENDIX "K."

3. In the valley of the Des Plaines and upper Illinois Rivers, excellent foundations for locks are available; the lower Illinois has a gentle slope, so that any reasonable depth can be obtained by dredging, and the present diversion of water from Lake Michigan through the Chicago Drainage Canal is more than sufficient for navigation purposes.

H. Doc. No. 762, 63rd Cong. 2nd sess.

Q. At any time since the beginning of the diversion from Lake Michigan into this waterway through the Sanitary and Ship Canal down to the present time, would that project depth and that project width have been available without any diversion from Lake Michigan in the stretch of the Illinois River from LaSalle to the mouth of it?

A. No, sir.

Q. By how many feet would the depth have fallen short of seven feet at low water at critical points of navigation?

A. About 4 feet.

Tr. Woermann, 4167.

Q. Since 1900 have there been sufficient appropriations for the improvement of that stretch of the Illinois River to have maintained a project dept of 7 feet without the diversion of water from Lake Michigan?

A. No, sir.

Q. At any time during that period?

A. No, sir.

Tr. Woermann, p. 4226.

Q. That is, Congress was providing a 7-foot channel as in its judgment sufficient for navigation on the Illinois River, and the engineers took such steps as they found necessary as conditions developed to give the 7-foot channel? Is that correct?

A. That is correct, if I understand it.

Q. When you state that but for this diversion the water in the Illinois River would have been 9 feet lower than at La Salle—am I correct?

A. Yes.

Q. And 6.5 feet lower at Peoria, and 4.3 at Kampsville, do you mean that if the Engineer Corps had done no more work in maintaining and improving the river the depths provided by the project would not have existed? Is that correct?

A. I mean that if the flow through the drainage canal was suddenly shut off the water would drop that amount.

Q. Yes; and that is because the Corps of Engineers did not do any more work during this period than was necessary to maintain 7 feet with the water that happened to be flowing in the river?

A. That might be stated that way.

Q. And, of course, it is ordinarily true in most projects that rivers must be dredged and maintained annually or the depth provided by the Government will not exist?

A. That is correct.

Q. And the Illinois River is no different in that respect than other rivers?

A. No, sir.

Q. In fact, the lower Illinois River is a much easier river in which to maintain depths by dredging than the majority of rivers in the United States, is it not?

A. Yes, sir.

Tr. Woermann, 4177-78.

Q. Was the seven-foot project adopted in 1880 by the Federal Government ever completed?

A. No, sir, except in the sense that I indicated Saturday, that by taking advantage of the increased flow it had been completed.

Q. Only in the sense that they happened to develop an artificial flow in that river which raised the depth of water. Is that correct?

A. That is correct.

Q. And, of course, all projects require constant dredging to maintain,

A. Yes, sir.

Q. And you would not expect any project adopted in 1880 to continue to have the required depth unless there was constant and regular maintenance dredging for that purpose, would you?

A. That is true.

Tr. Woermann 4207.

Q. On the 3rd of March, 1925, as conditions then existed, how long in ordinary practice would it have taken to have dredged or otherwise improved that stretch of the Illinois River from LaSalle to its mouth, so as to have made the project depth of seven feet and the project width of 200 feet available, with a diversion of only 3,000 cubic second feet?

A. About five years.

Q. How long would it take from the present time to accomplish the same result?

A. Practically the same.

Q. How long would it take now to accomplish that work without any diversion from Lake Michigan?

A. Well, roughly, I would say it would take two to two and a half times as long.

Q. That would be about how many years?

A. Ten or twelve years, anyway.

Tr. Fuller, pp. 4255-56.

A. From Utica to Grafton is a distance of about 23[illegible] miles, and in that 230 miles it drops only about 33 feet. So that in the improved river there were eventually fou[illegible] locks of about 8 feet lift each

Now, the river for that distance is down in an alluvi[illegible] plain, practically. The banks are quite level, and easil[illegible]

overflow in high waters. And the banks are alluvial, the bed of the stream is alluvial. It is a very level, slow moving river under ordinary circumstances, and it continues in that way until you get almost down to the Mississippi, and there the river has to go out into the Mississippi through a cut in between the high banks, at least on one side.

Q. State whether that section of the Illinois River would be difficult or easy to dredge?

A. Which section?

Q. From Utica to the mouth?

A. From Utica to the mouth is a section which is quite —has always been considered by all the various boards as exceedingly easy to dredge, and in one of the reports of the Chief of Engineers, annual reports, it was stated that, in the pools, places where the water had been dredged 20 feet, they had still held their depth for a great many years.

Mr. Adcock. I wonder if the General could state what report that was, so that the record will show.

By the Special Master:

Q. What report do you refer to General Bixby?

A. (Examining paper) I thought I had that, but I do not find it.

Mr. Adcock. Well, if it is not convenient, we will not take up the time to have him look for it.

The Special Master. We will proceed, It is hardly necessary to take time for that reference.

Mr. Adcock. No.

By the Special Master:

Q. Go on, General. You say the report is—?

A. The report is the report of Marshall's 1895. I think it is given in House Document No. 16—well, I will find it for you.

Mr. Adcock. I did not intend to ask him to look for it. I thought the General had it at hand.

The Special Master. Go ahead.

The Witness. Just one moment. Page 2716 Annual Report of 1895 reads as follows, in the report of Major Marshall:

"The channels dredged in the Illinois River are found to be nearly permanent. Channels dredged twenty years ago are but little deteriorated, and it is surprising to find that there has been no deterioration in the channels created by the Henry and Corpus Creek dams after from 15 to 28 years' use. We can then expect the cost of maintenance to be very little."

Tr. Bixby, 2107-9.

APPENDIX "L."

The board has also shown in discussing the sixth subject that the effect of diverting 10,000 cubic feet per second through the Chicago Drainage Canal from the Great Lakes will appreciably injure their navigability, and in its preceding report that such a diversion was not necessary to obtain either the 8 or 9 foot navigation recommended from Chicago to the mouth of the Illinois River. * * * (pp. 12-14)

If large amounts of water are to be admitted into the river, the removal of dams would reduce the damage to the valley from overflow from this discharge; but the board reiterates that a diversion exceeding 1,000 second-feet is not necessary for navigation purposes alone in the Illinois River, and that an added discharge will produce a slight and inadequate effect on the Mississippi River.

The object of diverting 10,000 or more second-feet from Lake Michigan is not primarily to benefit navigation, but to dilute sewage and to create power, and the United States should not be burdened with the cost of protecting the low-lands of the Illinois Valley from overflow where such diversion and overflow are unnecessary for navigation alone. (p. 14)

The existing projects for improving the navigation of the Mississippi River contemplate a channel 6 feet deep at low water from the mouth of the Illinois to St. Louis, and 8 feet deep from St. Louis to the mouth of the Ohio. These depths are ample for all existing river navigation. To provide for a reasonably prospective commerce, this board, in its report dated January 23, 1911, House Document No. 1374, Sixty-first Congress, Third session, recommends that an 8-foot channel be made from St. Louis up the Illinois River, thus affording a depth of 8 feet from the upper Illinois to the mouth of the Ohio, and that, should an increasing traffic demonstrate the necessity for additional facilities, a channel 9 feet deep be made. A depth of 8 or 9 feet; properly utilized, is sufficient for an enormous traffic.

The construction of the two dams referred to in the portion of the Act of June 25, 1910, quoted above, is not necessary to create depths of 8 or 9 feet. The desired improvement may be made at a much less cost, by the simpler methods of regulation and dredging. (p. 16)

W. H. BIXBY,
Brigadier General, U. S. Army, retired, President of the Board.

C. McD. TOWNSEND,
Colonel, Corps of Engineers, U. S. Army.

C. KELLER,
Major, Corps of Engineers, U. S. Army.

J. B. CAVANAUGH,
Major, Corps of Engineers, U. S. Army.

JOHN BOGART,
Civil Engineer. (p. 22)

APPENDIX B.

THE INFLUENCE ON VOLUME AND HEIGHT OF WATERS IN THE MISSISSIPPI RIVER VALLEY BELOW CAIRO.

New York, August 13, 1913.

Brig. Gen. William H. Bixby,
President, Lakes-to-Gulf Water Way Board.

Sir:

I have the honor to submit the following report upon the influence on volume and height of waters in the Mississippi River below Cairo by reason of any diversion of water from Lake Michigan for the maintenance of the proposed Lakes-to-the-Gulf Waterway.

The influence in volume of any diversion from Lake Michigan will be an increase in discharge approximately equal to the amount of the diversion, since the losses due to evaporation and other causes will not be large. At ordinary low water the percentage of increase in the volume of discharge due to the present authorized diversion will vary from about 2½ per cent at Cairo to 1½ per cent at New Orleans, and at extreme high water will be less than one-fourth of 1 per cent from Cairo to the mouth of the River.

Except as increase in volume results in increases of gauge height or of depth of water available for purposes of navigation, it will be of no importance within any limits of diversion heretofore considered as permissible.

The effect of any diversion upon gauge height will always be small, and at the highest stages practically nothing, but the exact effect at any time or at any stage is impossible to determine, since this effect will be complicated or obscured by various other changes in the regimen of the river.

An extended series of discharge observations of the Mississippi River was taken under the direction of the Mississippi River Commission from 1879 to 1885, at Columbus, Ky., below the mouth of the Ohio River; at Helena, Ark., below the mouth of the St. Francis River; at Arkansas City, Ark., Wilsons Point, Miss., and Hays Landing, below the mouths of the White and Arkansas Rivers; at Warrenton, Miss., below the mouth of the Yazoo River, at Red River Landing and at Carrollton, Ia. Mean discharge curves have been derived from these observations, and extended and checked by numerous observations made at later dates.

There is inclosed herewith a drawing containing a set of standard curves showing the mean or average relation between discharges and gauge heights at Columbus, Ky., Helena, Ark., Vicksburg (and Warrenton), Miss., and Red River Landing, the curves of relation for a rising river being flatter and for a falling river steeper than these standard curves. On the same drawing and at the left of the corresponding curves is also given a second set of

curves showing in tenths of a foot the theoretical increase in gauge heights at any stage due to an increase in discharge of 10,000 cubic feet per second, the second set being deduced from the first set by assuming that the increase in gauge heights due to this increase in discharge will be at the rate indicated by these standard curves. From these two sets of curves some idea can be had as to the increase in gauge height at any stage of the river which would result from any diversion from Lake Michigan.

However, the idea can be approximate only, for the increase in gauge heights due to a permanent increase in discharge would be more nearly indicated by the curve of relation for a rising river; and as this is flatter than the standard curve, the actual increase would probably be less than indicated by the curves shown.

Moreover, if the flow of the river at Cairo be permanently increased by diversion, any resulting increase in gauge height would bring about increased velocity due to the increase in slope, and the re-adjustment of conditions which would follow would tend to make the increase in gauge height due to the diversion less than that deduced from the standard curve shown.

Assuming that the increase in gauge height will not be accompanied by changes in cross section of river or that its effect will not be otherwise obscured, the diagram indicates that at all four places considered it would require an increase in discharge considerably exceeding 10,000 cubic feet per second to increase the gauge heights by 1 foot even at the lowest stages of the river.

Under similar assumptions, at stages corresponding to 40 feet at Columbus, the curves indicate that it would require an increase of over 50,000 cubic feet per second to increase the gauge height 1 foot at Columbus, Helena, and Red River Landing, or over 5,000 cubic feet per second to affect the gauge one-tenth of a foot.

At higher stages the effect would be even less, and it is evident that on extreme flood heights the effect of any permissible diversion would be trifling and would have no important bearing upon the heights of levees or other works designed to afford protection against floods.

The increase of navigable depths at lower stages due to any diversion would be less than indicated by the theoretical increase in gauge height, for elevation of the surface of the river has been found to be accompanied by a corresponding, though smaller, elevation of its bed.

In the Report of the Board of Engineers on Survey of Mississippi River from St. Louis, Mo., to its mouth, published in House Document No. 50, Sixty-first Congress, first session, page 44, it is stated as follows:

Repeated measurements (see graphical plot hereto appended) on the bar crossing of the Mississippi between St. Louis and Cairo show that up to a stage of about 20 feet above low water the available depth across the new bar is increased on an average only about one-half foot for every foot in the rise of water. (Between Cairo and Red River similar measurements show even less increase in navigable depth per foot or rise of water surface.)

Due to the permanent character of the diversion, the above ratio of elevation of water surface and river bed would not hold, and any permanent increase in gauge height would be less than that indicated by the standard curve, and would represent a change in the regimen of the river which would be accompanied by a rise of the river bed practicaliy equal to such increase. In any case, the gain in navigable depth would be insignificant for any permissible diversion.

Very respectfully,

J. B. CAVANAUGH,
Major, Corps of Engineers.

(pp. 38, 39, 40)

For purposes of navigation a diversion from Lake Michigan of less than 1,000 second-feet of water is all that will be necessary. For purposes of sanitation the works of the Sanitary District of Chicago were designed to allow the diversion of 10,000 second-feet and now contemplate a total of 14,000 second-feet, the additional 4,000 second-feet to be obtained by the diversion of water through the

Calumet River and a connecting canal following the Sag Route. The War Department, while awaiting the definite action of Congress, has so far permitted the diversion of 4,167 second-feet and the Sanitary District is understood to be using about 7,000 second-feet.

As the water which is at present being diverted from the lake appears to have already seriously affected the navigation of its harbors and connecting waterways, prompt congressional action is recommended to limit the diversion.

While it appears to have been assumed that the Sanitary District may be allowed to divert 10,000 second-feet so long as actually necessary for sanitary purposes, the diversion of the waters of the Great Lakes from their natural outlet for power development alone is inadmissible, under the recent treaty between the United States and Great Britain.

The future diversion of water from Lake Michigan for any purpose is fraught with difficulties. Not only has Canada an interest in the maintenance of lake levels which the United States must recognize, but every foot of water flowing through the Chicago Drainage Canal lessens the flow at Niagara Falls and at the power sites along the St. Lawrence River, where, due to the fall available, the same amount of water will create about four times the power that can be generated from it on the Des Plaines and Illinois Rivers.

The treaty enables riparian owners of Canada, as well as of the United States, who consider themselves injured by such diversion, to bring suit in United States courts to protect their interests. The claim that more than 1,000 cubic feet per second is required for purposes of navigation cannot be maintained.

The treaty, however, recognizes as proper the use of water for sanitary purposes and it is the opinion of the Board that only such water should be diverted from Lake Michigan as is indispensable for sanitation, and then only with a provision for proper compensating works in the outlets of the lakes to prevent a lowering of their levels.

Water thus diverted may be used incidentally for power purposes, but care must be exercised in authorizing the diversion of water for sanitary purposes, to restrict it to the amount necessary for these purposes alone. (pp. 106-107.)

Exhibit 171, Trans. 8031-40.

Excerpts from H. Doc. 762, 63rd Cong. 2nd sess.

EXCERPTS FROM OFFICIAL DOCUMENTS RELATIVE TO THE AMOUNT OF WATER REQUIRED FOR PURPOSES OF NAVIGATION ALONG THE ILLINOIS RIVER.

Exhibit 182.

Excerpts are from the following documents:

H. Doc. No. 1374, 61st Cong., 3rd sess.

H. Doc. No. 762, 63rd Cong., 2nd sess.

Decision of Secretary of War, Henry L. Stimson, dated January 8, 1913.

Warren Report, dated August 30, 1919.

Letter of Brig.-Gen. W. H. Bixby, Chief of Engineers, to Secretary of War, dated Feb. 28, 1912.

H. Doc. 1374, 61st Cong., 3rd sess:

Waterway from Lockport, Illinois, to mouth of Illinois River.

Page 7:

The board considers a bottom width of 160 feet in canal and 200 feet in the open river above the mouth of the Illinois sufficient for a channel of 8 or 9 feet available depth. For safety and ease of navigation the channel should be excavated to 11 feet in rock cuts and canals, and the locks should be given 11 feet depth, 80 feet width, and 600 feet useful length. With these lock dimensions three barges carrying about 9,000 tons of freight, may be locked through with their tow boat. A waterway of these dimensions would have a capacity exceeding 100,000,000 tons

per annum, and would accommodate barge tows carrying about nine times the ordinary train load of this vicinity. In addition, the vessels using it would be capable of navigating the Ohio and lower Mississippi Rivers. Such a waterway will not require a diversion of more than 1,000 second-feet from Lake Michigan, and this amount would not injuriously lower lake levels nor cause excessive flooding of lands in the Illinois Valley.

Page 8:

For purposes of navigation a diversion from Lake Michigan of less than 1,000 second-feet of water is all that will be necessary. For purposes of sanitation the works of the Sanitary District of Chicago were designed to allow the diversion of 10,000 second-feet and now contemplate a total of 14,000 second-feet, the additional 4,000 second-feet to be obtained by the diversion of water through the Calumet River and a connecting canal following the Sag route. The War Department, while awaiting the definite action of Congress, has so far permitted the diversion of 4,167 second-feet and the Sanitary District is understood to be using 7,000 second-feet. As the water which is at present being diverted from the lake appears to have already seriously affected the navigation of its harbors and connecting waterways, prompt congressional action is recommended to limit the diversion.

Page 9:

The claim that more than 1,000 cubic feet per second is required for purposes of navigation cannot be maintained.

H. Doc. No. 762, 63rd Cong., 2nd sess:

Final Report—Waterway from Lockport, Illinois to Mouth of Illinois River.

Page 14:

* * *; but the board reiterates that a diversion exceeding 1,000 second feet is not necessary for navigation purposes alone in the Illinois River, and that an added

discharge will produce a slight and inadequate affect on the Mississippi River.

Decision of Secretary of War, Henry L. Stimson, dated January 8, 1913, denying the application of the Sanitary District of Chicago to withdraw from Lake Michigan 10,000 cubic feet per second of water:

"On the other hand, the demand for the diversion of this water at Chicago is based solely upon the needs of that city for sanitation. There is involved in this case no issue of conflicting claims of navigation. The Chief of Engineers reports that so far as the interests of navigation alone are concerned, even if we should eventually construct a deep waterway from the Great Lakes to the Mississippi over the route of the sanitary canal, the maximum amount of water to be diverted from Lake Michigan need actually be not over 1,000 feet per second, or less than a quarter of the amount already being used for sanitary purposes in the canal. This estimate is confirmed by the report of the special board of engineers on the deep waterway from Lockport, Ill., to the mouth of the Illinois River, dated January 23, 1911. It is also confirmed by the practical experiences of the great Manchester Ship Canal in England. From the standpoint of navigation alone in such a waterway too great a diversion of water would be a distinct injury rather than a benefit. It would increase the velocity of the current and increase the danger of overflow and damage to adjacent lands.

WARREN REPORT, Dated August 30, 1918.

Last 2 sentences in Par. on top of page 109:

"It is estimated that 500 cubic feet per second would be ample to serve any navigation requirements of the present canal. Should the Des Plaines and Illinois Rivers be improved to accommodate navigation of 8-foot draft to the Mississippi, a diversion of 1,000 cubic feet per second might be required to meet the needs of navigation only."

First in middle of page 111:

"The Board of Engineers considered a volume of flow of water of 1,000 cubic feet per second more than sufficient for such a waterway."

First Para. on page 116:

"Diversion: It has never been necessary to estimate the diversion of water from Lake Michigan which would be required to operate the drainage canal as a navigable waterway, provided no sewage or water for sewage dilution or water for power development purposes were discharged into it, but it seems probable that 500 cubic feet per second would suffice amply. If the Des Plaines and Illinois Rivers route for 8-foot navigation is developed, 1,000 cubic feet per second may be required from Lake Michigan."

First Para. on page 66:

"It is estimated that 500 cubic feet per second would be ample to serve any navigation requirements of the present canal. Should the Des Plaines and Illinois Rivers be improved to accommodate navigation of 8-foot draft to the Mississippi, a diversion of 1,000 cubic feet per second might be required to meet the needs of navigation only. The present use of the canal for navigation is very small, there having been only 360 lockages at the power house in 1913, the longest boat locked through being 75 feet long."

Last Paragraph on First Page, page 19:

"The diversion through the Chicago Sanitary Canal averaged 8,400 cubic feet per second in 1917, although some years' averages were 10,000 cubic feet per second or more. Of this diversion, 6,800 cubic feet per second is indispensable used in the development of power, as will be explained later. Such small navigation as now exists would probably require a diversion of 500 cubic feet per second, and even that amount would be sufficient for the needs of the greatest probable commerce of the so-called Lakes-to-Gulf Waterway."

Letter of General W. H. Bixby, Chief of Engineers, U. S. Army, dated February 28, 1912, for the Secretary of War (memorandum as to the Sanitary District diversion of water from Lake Michigan through the Chicago River, Sanitary District Canal, Illinois River, to the Mississippi Valley.) Published in Hearings on the subject of the improvement of the Illinois and Mississippi Rivers and Diversion of water from Lake Michigan and the Illinois River, before committee on Rivers & Harbors, H. R., 68th Congress, 1st Session, 1924, Part 2, page 728:

"For the purposes of navigation alone by canal and canalized river from Lake Michigan to the Mississippi River, on the Illinois River and its headwater and connecting canals, and to keep the locks and pools full, a diversion from Lake Michigan of less than 1,000 second-feet of water will easily supply any reasonable demands and is all that will be actually necessary, and any greater diversion is a greater injury than benefit to navigation."

Exhibit 182.

Q. In your opinion, how much lockage of water would be necessary to operate a 9-foot channel from Lockport to Utica?

A. The channel from Lockport to Utica, being slack water navigation, lock and dam navigation, you only need enough water to keep the pools full, and the pools will stay full, except for evaporation, unless boats are passing through the locks; so that all that is necessary is to furnish water enough for the lock passage of the boats through the locks, to furnish lockage water plus a very small amount to cover evaporation.

Q. In your opinion, how much would that lockage water be?

A. The board that was called on by Congress to report on this route from Lockport to Utica—

The Special Master: You were asked for your opinion, General.

A. My opinion?

The Special Master: Yes.

A. From 500 to 1,000 feet per second will furnish all the lockage water that is necessary for about 60,000,000 tons a year down the river.

Q. Of course during the closed season of navigation no lockage water would be required?

A. None is needed during the closed season of navigation for navigation purposes, and, therefore, none for lockage purposes.

Bixby, Trans. 2116-17.

Q. General, are you familiar with the quantity of lockage water used by the Panama Canal?

A. The lockage used by the Panama Canal is given in their official report for 1925 and 1926.

Mr. Adcock. If the General knows approximately, let him state it.

A. (continuing) The annual report of the Panama Canal for 1925, pages 4, 13, and 14, shows that through the summit level in both directions, to and from the Atlantic and Pacific Oceans, the passage of 23,958,836 cargo tons, loaded in 16,877 vessels, by means of 1448 locks, using 31,300,000,000 cubic feet of water, which reduced to second feet per year amounts to 992 second feet per year. The annual report for 1926 shows a similar movement of 26,000,000 cargo tons and 989 second feet per year.

That is based on the fact that one second foot per year is equivalent to 31,536,000 cubic feet. That 989 and 992 feet per second is from the summit level both ways, to both oceans. So that from the summit level to both oceans, on the average, it is less than 500 feet per second for the whole cargo tonnage of the Panama Canal. There is a lot of surplus water running to waste at the spillway which greatly exceeds the amount of the lockage, so they do not have to be very economical.

By Mr. Jackson:

Q. General, is the lockage from Lockport to Utica run both ways or just one way?

A. Only one way, from Lockport to Utica, the summit level being the highest level and nothing from the summit level into Lake Michigan. The summit level and Lake Michigan are the same.

Bixby, Trans. 2126-27.

Q. Assuming that, Colonel, in the proposed waterway of the State of Illinois from Lockport to Utica, the locks are 600 feet long, 110 feet wide, with a maximum lift of 41 feet, what quantity of water, in your opinion, would be required to operate those locks for a 9-foot waterway, for any commerce which could reasonably be anticipated for that waterway?

A. At the time that I was a member of the Board that you have just referred to, I was directly chargeable by the Board with making an analysis of the requisite water supply for a waterway somewhat similar in its dimensions to those mentioned by you as being the adopted dimensions for the waterway now under consideration by the State of Illinois, and my conclusion was that a water supply for which a 1,000-second feet per day for the 365 days of the year would be more than sufficient to accommodate a traffic of 100,000,000 tons annually.

Keller, Trans. 1269.

Q. In your opinion, would any such tonnage be available for such a water way?

A. I made no direct attempt to analyze the traffic possibilities of the Illinois waterway. My private opinion is that the possibilities are large, but that they will ever exceed 100,000,000 tons annually within a measurable period of time I somewhat doubt. I have compared the tonnages, the traffic actually recorded for some of the great ports of the world with this figure of 100,000,000 tons, and I have prepared a brief table which, if it is agreeable to you, I will be very glad to repeat here.

Q. Will you produce that table?

A. I cannot, of course, remember the figures.

Q. Will you read that into the record, such part of it as you wish to use in your testimony?

Mr. Adcock. Just a minute.

By Mr. Adcock:

Q. Was that prepared by you, Colonel Keller, or was it prepared just for this occasion?

A. It was prepared some time ago, but for this occasion, however.

Q. I see.

A. And it was prepared at the office of the Board of Engineers for Rivers and Harbors, from the best available figures accessible to that Board.

Q. Well, is the table which you have before you, and from which you are about to read—I understand that that was prepared in the office of the Board of Engineers for Rivers and Harbors?

A. Yes.

Q. Was that before you retired?

A. No, quite recently. I retired three years ago.

Q. What I want to get at is this: It was in response to a request for certain information that you asked for, is that correct?

A. I asked for the foreign commerce of certain named ports.

Q. Yes.

A. Which was included in this table. Now the Board of Engineers, as you probably know—

Q. Had that information?

A. Is constantly engaged in researches requiring them to have this information available for them, and so my request was merely a routine request, such as they would honor for any private individual.

Q. I understand. I had not raised any question about that. I merely wanted to know how the table came to be prepared.

A. It was prepared at my request for the purpose of getting some definite measure of the traffic in tons for some of the great ports of the world, my idea being this: that with this waterway constructed and actually used, Chicago will be in a condition, so far as commerce is concerned,

which will be comparable to some of these great ports; that is, the business will be similar to that of some of these great ports. So that I wanted to measure the likelihood of whether the traffic would be limited to that figure that I gave, namely, 100,000,000 tons annually.

Q. So that you asked the Board of Engineers for certain information?

A. Yes.

Q. And they prepared this table that you now have and sent you this table?

A. Yes, sir.

Mr. Adcock. That is all.

Mr. Jackson. Is there any objection to its being read?

Mr. Adcock. No.

Witness: Now, these figures are only those of foreign commerce, that is, of imports and exports for the port named.

The first one is New York: Imports 10,481,786 tons. Exports 10,174,880 tons.

These figures being for the year 1923, the calendar year, the latest complete year available for all the ports in the table.

London was 13,995,000 tons imports and 8,385,000 tons of exports.

Antwerp, 12,188,000 tons of imports; 7,600,000 tons of exports.

Amsterdam, 3,461,000 tons of imports and 1,200,000 tons of exports.

Hamburg, 14,546,000 tons of imports and 11,858,000 tons of exports.

The Panama Canal returns are totalized, without separating them into imports and exports, since it is all through traffic, and the figures for 1923 were 21,916,000 tons.

Rotterdam, 13,533,000 tons of imports and 3,742,000 tons of exports.

Liverpool, 9,918,000 tons of imports and 9,620,000 tons of exports.

Marseilles, 3,999,000 tons of imports and 2,265,000 tons of exports.

Hongkong, 16,830,000 tons of imports and 17,622,000 tons of exports.

The largest total in the table is that of Hongkong, just read amounting to, roundly, 34,400,000 tons of imports and exports.

In addition, it should be noted that, for the Port of New York, we have more comprehensive figures relating to the entire traffic of the port, domestic as well as foreign; and I have appended to the table a footnote relating solely to the Port of New York, subdivided as follows:

Coastwise receipts, 18 271,371 tons.

Coastwise shipments, 9,861,816 tons.

Internal traffic, 8,875,254 tons.

Local traffic, 10,473,520 tons.

Intra-port traffic, 48,977,348 tons.

Making a total domestic of 96,459,309. Adding in the foreign traffic for that year, we have a grand total of 117,115,975 tons—all short tons.

By Mr. Jackson.

Q. Do you know whether the intra-port traffic is largely car ferry traffic?

A. It is exclusively car ferry traffic, of a character peculiar to the Port of New York, arising from the fact that most of the terminals of the railroads entering the Port of New York are on the New Jersey side of the Harbor, and that foreign traffic must be transferred back and forth between Manhattan and Brooklyn and the Jersey on car floats or car ferries.

Q. Colonel, in asking a question in regard to the quantity of water required for lockage in this waterway, I mentioned one lock of 41 feet?

A. Yes.

Q. Assuming that that is the summit lock, and there are four other locks in that waterway, of lesser lift, would that in any way vary your estimate as to the quantity of water required?

A. No, for through traffic the lock of maximum lift is the one the water demands.

Mr. Jackson. Cross examine.

CROSS EXAMINATION.

By Mr. Adcock:

Q. Now with reference to the amount of water that you speak of, 1,000 second feet, that related solely and only to the amount required for the locks between the southern terminus of the Sanitary and Ship Canal of the Sanitary District of Chicago and the Illinois River?

A. Yes, the mouth of the Illinois River.

Q. What is that?

A. The mouth of the Illinois River.

Q. Well, then, you were assuming that there would be locks and dams between the southern terminus of the sanitary canal and Utica, or the Illinois River, were you?

A. Oh, yes.

Q. And also the locks and dams to the mouth of the Illinois River?

A. Oh, yes It was a canalized waterway.

Q. Entirely?

A. Yes, sir.

Q. Your answer was that it was entirely canalized?

A. Yes, sir.

Q. In other words, there would not be a foot of the way but what you would be upon slack water, is that true?

A. Yes, except below the last lock.

Q. Except below the last lock?

A. Yes, sir.

Q. And you did not intend your answer as to that 1,000 second-feet to relate in any way to the water that might be required in the Illinois River for navigation, in the event that there were no locks and dams in that river?

A. No, sir, because the project that the Board of which I was a member considered and recommended required a slack water channel.

Q. Yes, and that was the one you were considering?

A. That is the one we considered as justified at that time.

Keller, Trans. 1269-1276.

TOTAL DISCHARGE OF LAKE SUPERIOR AND WATER USED BY NAVIGATION CANALS AT THE ST. MARYS FALLS, MICHIGAN-ONTARIO.

Year	Total Discharge Lake Superior C. F. S.	Used by Navigation Canals c. f. s. U. S. Canal	Canada Canal	Total
1918	61,105	662	134	796
1919	54,135	824	112	936
1920	67,412	1,409	108	1,517
1921	51,385	681	107	788
1922	44,441	727	104	831
1923	51,219	783	110	893
1924	50,326	740	98	838
1925	56,486	796	106	902
Mean	54,564	828	110	938

Exhibit 62.

Q. Mr. Sabin, your attention has been called to complainants' exhibit 62, which was the table produced and identified by Colonel Dent, as the amount of water used for lockages in the Soo Canal, and your attention was directed particularly to the fact that the lockages for 1921 seemed to be larger than for the following years. For a number of years, you testified the other day—nineteen years down to 1925—you were superintendent of the locks at the Soo. Do you know of anything that happened or any special condition existing there in 1920 that would explain that increased lockage water?

A. May I refer to that table? I think you have mentioned the wrong year, unless I am mistaken. I think I recall it. The year of large supply was 1920.

Q. 1920, that is the year I intended to state.

A. In the fall of 1919, in November, the guard gates, the upper gates of the third lake, which are used in pumping out the lock to unwater the lock, were injured by a storm. They were drawn away from the sides where they are anchored, and were wrecked, to such an extent that

it was impracticable to close them that fall for pumping out the lake. And during that water, the repairs were made to them, and it was desired to replace the gates in the spring, and in order that there should not be too great a thickness of ice to contend with in the spring, the water was allowed to flow through that lock freely during the winter months, from December to March, inclusive, until the gates had been repaired and replaced to permit pumping out. That, I think, would account easily for the difference.

Q. It was the year 1920 that I had in mind, Mr. Sabin. So that at that time there was water going through the locks that was not actually being used for lockage purposes?

A. There were, I think, about four months when the water was running freely through the culverts.

Sabin, Trans. 1278-80.

Q. What do you know about the amount of cargo which commerce carriers during the season of 1925 and 1926 could carry through the ship canal and locks of the Sault Ste. Marie?

A. The exact figures are in the room somewhere, but I can say roughly that it was around 90,000,000 tons.

Dent, Trans. 635-36.

Q. And with those stable banks and beds there is no doubt in your mind that a 9-foot channel can be obtained in the Illinois River with a diversion of a thousand second-feet, or less, is there?

A. Yes, there is.

Q. In March of 1926 you testified at the hearings before the Committee on Rivers and Harbors, House of Representatives, 69th Congress, 1st session, on the subject of the improvement of the Illinois River and the abstraction of water from Lake Michigan?

A. I presume so, but I do not remember the dates.

Q. I read to you from what purports to be your testimony or statement on page 61 of that document; and to make it clear to you, I will read the questions with your answers:

"Mr. Chalmers. I think that is the most important question in the whole problem, whether any more water is required for navigation purposes by the removal of those locks.

"Mr. Barnes. The Engineering Board has dealt with this in its report. They say that open river navigation can be obtained with any flow above, I believe, 2,000 cubic feet per second—

"Mr. Chalmers (interposing). Right there, before you go on: With two locks in the river the flow can be controlled for 1,000 feet. Is not that true? Is not that sufficient?

"Mr. Barnes. No, sir.

"Mr. Mooney. One thousand six hundred, is it not?

"Mr. Barnes. No, that is not sufficient. I beg your pardon. If you go on and excavate sufficiently, then you can do it."

Did you so testify before that committee?

A. I presume I did, but that is not slack water navigation.

Q. Then it is now your testimony that with that flow of water you could obtain a 9-foot channel without slack water navigation, but that you could not obtain it with slack water navigation. Is that it?

A. By enormous expense you can do almost anything in any stream. The Illinois River has a fall of about 35 feet, as I recall it, in its full length. Various methods of making slack water navigation have been proposed, all the way from six locks to only one lock; and it is a matter of cost and a matter of damage as to which method is the more practical and feasible to use.

Q. The enormous cost to which you refer is one in which the Federal Government is concerned, if any one, is it not?

A. If the Federal Government is to improve it.

Q. Regardless of your opinion as to the desirability or undesirability of locks, do you wish to testify that you cannot obtain a 9-foot channel in the Illinois River with locks and dams and with a diversion of 1,000 second feet or less?

A. I would testify that you can make a canal. I say it is inadequate and inappropriate for the purpose, but a canal can be obtained for a thousand cubic feet per second if enough locks are put in to make complete slack water.

Q. With a channel fully as large in area as the channel which you are providing in the Illinois waterway?

A. No.

Q. As to width?

A. No, sir.

Q. You mean, it would be better than 160 feet?

A. Of course you can excavate it to any width you want.

Q. You mean that the water would not supply the channel of the same width as that of the Illinois section of the waterway?

A. No.

The Special Master: Do you mean to say, no, it would not supply that—or—no, that you did not mean that?

The Witness: The Illinois waterway has channels from a minimum of 150 feet to as much as a thousand feet in width. The slack water navigation of the Illinois River, with the locks that have been proposed, does not give as full width and as full a depth as will obtain in the Illinois River. However, it is entirely possible to so locate the locks and so make your excavations as to give as great width as we will have in the Illinois waterway above.

Barnes, Tans. 7095-98.

Q. Mr. Barnes, I would like to direct your attention to a statement of General Taylor made before the same committee on pages 284 and 285 of the same document, where he says:

"Senator Willis. Some one said, it was my impression that it was you, that without any diversion at all, there

is sufficient water in this drainage basin to operate this canal without taking any water at all from Lake Michigan.

"General Taylor. That is, from Utica to the Mouth?

"Senator Willis. Yes.

"General Taylor. Yes, sir; that is correct. There might be, at times of extreme low water, a short period when there would not be sufficient water to operate the waterway to its full capacity, but those times are few and far between and the periods would be short. Ordinarily there is water enough there to operate that waterway from Utica to the mouth, without any water from the Lake."

Do you agree with that statement?

A. If you assume that there were some locks remaining in, you could operate from Utica to the mouth in many years, without water from Lake Michigan. However, Utica is nearly 100 miles from Chicago and there is no commerce at Utica worth the name, and no engineer would recommend the improvement of the lower Illinois without extending it to Chicago.

Q. Yes. Well, we will take that separate section up individually, because different conditions prevail; but, as to the section covered by General Taylor in this statement, do you agree with him?

A. I agree that if you make slack water navigation, with five or six or seven locks in the reach between St. Louis and Utica, you can secure a fair amount of water ordinarily for lockage purposes.

Barnes, Trans. 7045-47.

Q. Mr. Barnes, if the quantity of water diverted at Chicago were reduced to a thousand second feet, the only effect that would obtain upon the construction of the Illinois waterway would be on the question of the excavation of the channels between those locks, would it not?

A. No.

Q. What additional factor would be involved, if any?

A. There would be the additional depth it is necessary to go in the location of the locks and the design of the locks, the depth of the bottom of the sills.

Q. You have just told me that as the locks are now designed, they would provide for all traffic over a waterway having a controlling depth of 9 feet.

A. But mind you, we must make those locks 14 feet.

Q. But we will confine ourselves for the time to 9-feet, and assuming a waterway of 9 feet, would there be any effect by way of the reduction of the Chicago diversion to 1,000 second feet other than the question of possible additional excavation in the channels between these various locks and dams?

A. Nothing between the locks and dams; but I must insist that those locks must be made lower; that is, we must go lower in order to comply with the law of the state.

Q. Mr. Barnes, I would like to insist that we leave aside the legal questions that you may or may not have involved in your state, and have you answer my question as to whether or not with a diversion reduced to a thousand second-feet a 9-foot waterway might be obtained in this stretch which is shown upon your exhibit 1194, without any further change other than possibly additional excavation in the channels between the locks.

A. That is true for a 9-foot waterway.

Barnes, Trans. 6812-13.

Q. Mr. Barnes, I note that on page 5886 of your testimony you made this statement, after referring to the low water flow of the Illinois as 500 cubic second feet at La Salle, as you have just stated:

"This increases down stream until at the mouth it will have a flow of approximately 1,000 cubic feet per second. That is not sufficient to economically develop an adequate channel, without the intervention of locks."

In that statement did you mean to infer that, by the intervention of locks, an adequate channel might be economically developed?

A. Well, I do not think it would be adequate, but a channel can be obtained; there is no question about that.

Q. Well, you would have just as large locks, would you not?

A. You could have locks—the locks would have to be governed by the quantity of water to supply them, or by the commerce. I do not think that the size of the locks is governed very much by the sufficiency of the water for lockage purposes.

Q. And in view of that fact, Mr. Barnes, you would have just the same size locks, or could have, as you would have on the Illinois waterway, could you not?

A. Yes, sir.

Q. And those locks would have much lower life requirements than on the Illinois waterway?

A. Yes.

Q. And would require a much smaller quantity of lockage water for a given commerce?

A. Yes.

Q. And you could dredge to the same depth that you would have in the proposed waterway, of 9 feet, could you not?

A. I suppose so.

Q. Well, there is no question in your mind but what you could dredge that way?

A. I think there is no question of that. There is a very serious question as to the economy of any such thing.

Barnes, Trans. 7114-16.

APPENDIX "M".

GENERAL W. H. BIXBY.

a witness heretofore called by and on behalf of the plaintiff, and duly sworn, was recalled for further examination and testified as follows:

DIRECT EXAMINATION by Mr. Le Boeuf.

Q. General Bixby, you have previously stated your educational and professional qualifications as an engineer. I ask you now to specifically state your special experience with reference to the improvement of rivers for navigation, with particular reference to your observation, engineering work and experience on the Mississippi River.

A. I claim to have had unusual experience in matters concerning the Mississippi.

Mr. Adcock. I move to strike that out.

The Special Master. Yes, General. The point is not whether you think it is unusual, but what it is.

The Witness. Yes. On the Mississippi, I was not only the district engineer for a while, in direct charge of the work, from St. Louis down to Cairo, but also the division engineer, to inspect and supervise all the work of the districts of the Mississippi, including the Missouri and the Upper Mississippi and the Lower Mississippi, and the Illinois, as a tributary. I was also the president of the Mississippi River Commission for several years. So that under me, as President of the Commission, I had all the dredging work of the river to look after, and all the bank protection to look after and supervise, with the assistance of four or five other men, who were scattered along the river from St. Louis to Memphis, and Vicksburg to New Orleans. That work also included the supervision of the work away down to the Gulf. That required me to go over the river several times. It required me to go over the Mississippi River with the Commission at high water, when the banks were being overflowed, and the crevasses were in action. Also to go over it at dead low water, when the banks were all in sight—or the bank revetments were

in sight, and when the condition of the banks could be easily seen, and the effect of the water flow on them judged.

It included, of course, the inspection of the upper river in the same way, and the reservoirs up in Minnesota, that supplied water at times to the navigation of the river at St. Paul.

As already stated, I was chairman of the two boards, for survey of the ports on the Mississippi River, from Chicago to Lockport—I mean Lockport to St. Louis, and Chicago to St. Louis, and St. Louis to the Gulf. And one board was in 1909 and the other board was in 1913.

In between those two boards, I had the opportunity of going with the International Waterways Commission, to Europe, and inspecting all the rivers there, and checking up in that way, and while I was of assistance to the board, I had an opportunity to check up with the foreign engineers the work we were doing on the Mississippi River, and see how our work compared with their work, and to get their ideas. And so that came in between 1909 and 1913, on those two boards.

Of course, after that, as Chief Engineers, all the work was under my general supervision, and that brought in any question as to the Mississippi River, because the Mississippi River Commission was acting under the supervision of the Chief of Engineers.

Also, while I was at St. Louis, in 1908 or 1910, and also during the World War, I was under the Department of Commerce as Light House Inspector. That also required me to go over the river with another set of officers and men. So then I had the opportunity of talking with the captains and pilots of the Light House Service. On the other trips I had the opportunity of talking with the captains and pilots of the river service. The work of the district and of the division and of the Mississippi River Commission came back to me again during the World War. So that, even then I had all of those, and later, after a while, had the Missouri River also, with its offices at Kansas City; so that I could check up on the work there.

By Mr. Le Boeuf:

Q. General, will you please describe the condition and character of the Mississippi River? And by that I mean its natural characteristics, rather than those affected by works of improvement.

A. Well, the Mississippi River is a river with a shifting, movable bottom, bed and banks. And that is the peculiarity of the Mississippi River which puts it in line with all rivers with a movable bottom, a changing or shifting bottom. The river itself, the Mississippi River, from Grafton—well, from St. Paul down to St. Louis, is a small river with a comparatively hard bottom, wide and shallow. It carries the mass of the water flow, during the average of the year, into the river above St. Louis. While the river is not as long from St. Paul down, as it is from the Yellowstone Park down (as the Missouri), still the character of the bottom is such, and the meteorological conditions, due to climatic conditions, are such that it furnishes more water to the river, the Upper Mississippi River does, than the Missouri River does. But the Upper Mississippi River, while furnishing more water, does not carry very much in the way of sediment, sand, or other material. It is the Missouri, with the little lesser flow, but the higher floods and the large volumes during the floods, that tears up the beds and the banks and sends down the sand rolling along the bottom, and the sediment that is transported by the water.

Now, from the time that you get to the confluence of the Missouri and the Upper Mississippi, which is just above St. Louis, then we have the peculiar characteristics of the Mississippi, that it is composed of deep pools, separated for three or four miles by bars. The average depth of the river is much greater than any draft that we asked for for navigation. The river itself—

By Mr. LeBoeuf:

Q. What is the average depth, exclusive of bars?

A. I do not carry the average depth in my head, so I want to refer to my notes. The average depth in the river from St. Louis to Cairo is 18 feet. From Cairo down

to Memphis is 31 feet. From Memphis down to Vicksburg it is 37 feet. From Vicksburg down to the mouth of the river it is 48 feet. So if it were not for the bars there would be plenty of draft for ocean vessels. But these bars occur every three or four miles between Cairo and the mouth of the Red River. When you get down to the mouth of the Red River there are large bars on the bottom of the river, but they are so far down that they rarely ever interfere with navigation.

By the time you get down to Baton Rouge, or a little below Baton Rouge, the river is so deep over these bars that any steamer that can come in from the Gulf through the passes at the mouth of the Mississippi can go all the way up to Baton Rouge without difficulty.

These pools are not constant any more than are the bars. The pools between St. Louis and Cairo vary so that in some places they are 90 to 100 feet deep in spots. In places we sound one year and find a moderate depth and a few years afterwards in the same place we find that the depth has increased enormously, showing that the pools gradually fill up and gradually scour away, in the same way that the bars rise and form and then afterwards scour away.

The depth in that way between Cairo and St. Louis, as I say, has at some times been found to be thirty or forty feet and at other times it may be one hundred feet.

Mr. Adcock. I was wondering if there is a question pending.

The Special Master. Yes; the question pending is as to a description of the Mississippi.

Mr. Adcock. That was the natural condition. The question should be confined to that.

The Special Master. Yes.

The Witness. I am talking now about the natural conditions. Of course, we have to find out the condition of the bars which govern the navigation of the boats under natural conditions before any improvement, and we do that by looking up back records and also by checking up

on what happens during periods that we actually have seen.

So that the natural depth between St. Louis and Grafton at times has been not over 18 inches or two feet, between Grafton and the mouth of the Missouri.

Between the mouth of the Missouri and Cairo the natural depth on the bars has been somewhere between three and four or five feet; even in recent years the bars have developed at very low stages, showing the river, if left alone, would only have three or four or five feet. Below Cairo down to Vicksburg the natural depth is between 4½ and 6½ feet.

The Special Master. You are speaking of over the bars?

The Witness. Yes; the depth over the bars is as low as that. Now, these bars, as I say, do not stay quiet; they not only rise and fall, but they travel down stream and actual measurements in plotting the results of the surveys have shown that the bars wash away on the upstream side, fill up on the downstream side, and gradually change in their position, so that sometimes a bar is found in a place which the records show many years before was a deep pool.

As these bars move down stream they gradually diminish in height and fade away, as you might say, and as the bar has moved from one position downstream to where it has pretty nearly disappeared in height, another bar begins to form up above and gradually moves down and occupies later on the position that the other bar formerly occupied. So that the bottom of the stream has been found to be constantly changing and the bars constantly moving, the pools constantly filling up and scouring away.

By Mr. LeBoeuf:

Q. General, will you describe a year in the life of a Mississippi bar? Start in the first part of a year and tell us what happens during the year to one of these bars.

A. The general condition of the river from early in the navigation season, which commences about January or February, to the end of the navigation season, which is

somewhere about November or December on the Mississippi, between St. Louis and the Gulf, moves along in a regular routine, which is tied up more or less with the stage of water.

In the winter the river is low. Its lowest times are in December. In December the water is away down below the low water of the navigation season. The low water which the reports state at St. Louis which used to be a standard low water of 4 feet on the gauge now is 1 foot on the gauge as the low water of the navigation season and it is not the lowest water by any means on the river.

At the low water of the navigation season the flow of the river has been measured and is taken at 40,000 second feet, but once or twice they have succeeded in getting a discharge at a lower stage than that for the navigation. That is along during the winter when this discharge was as low as 20,000 second feet, and even that was at the stage a couple of feet higher than the other recorded lows. So that the discharge possible at dead low, which has never been measured, but has to be estimated, may run down as low as 15,000 second feet at St. Louis, but nobody seems to pay any attention to that, because the boats are not moving, the river is not being moved, and quite evidently it is full of ice, so that there are no good opportunities for making discharge measurements, and the amount of water flowing has no effect on navigation nor on commerce in any way.

The low water being in December, the stage being way down below the low water navigation, and there being a very small flow in the river, everything is quiet on the bottom of the stream, and the previous work of the season has cut channels through all the bars, so that the draft all through December and January is good and usually 8 feet from St. Louis down to Cairo and 9 feet, or perhaps a little bit more, from there down to Vicksburg. That is the condition during the winter before the navigation season starts in, and that is the condition in February when the navigation recommences.

Then the water gradually rises under the influence of the spring freshets up in the Upper Mississippi and up in

the Missouri basin, and as their waters come down with the melting of the snows and the ice the river gradually rises at St. Louis. It goes on with a steady, gradual rise up until about April or May. In May it gets up to pretty nearly the full stage but not quite. During that time the navigation channel is even better than it was before, because as the current of the river is gentle and gradual there is not as much material that comes down the river and lodges on the bars as at other times. If the bars rise a little bit the old dredged channels fill up a little bit, but as the bar does not rise as fast as the river stage rises, there is always an increase in the navigation depths. So that navigation depths may go on increasing and getting better until April or May or even June.

So that the boats always have more than they need and the dredges have nothing to do. That is on the supposition that the water rises gradually. If it should happen to rise for some reason very fast, as with an unusual flood, and then drop very suddenly afterwards, the bars might reform, as they do in the fall, and cause trouble, but that rarely ever happens. So that along in June or July there is nothing up to that time in the way to bother the boats and nothing to require dredges to come out and do any work. But between July and August the river reaches, as a rule, its maximum. Its average is about 20 feet on the gauge.

Q. The gauge at what point?

A. The gauge at St. Louis. However, sometimes between July and August the river goes up to 30 feet. Once in a while it has gone up to over 40 feet. So that at times it gets up to where it occasionally may not only be bankfull, but it may overflow the banks. Of course, during that time there is no trouble with navigation by reason of drafts, because there is probably 20 or 30 feet more than the 8 feet required for navigation.

Commencing in August and from August to September all these floods that have come from the winter's melting of ice and spring rains have begun to disappear.

Q. May I interrupt you, General, to ask you what has been happening to the silt on the river bottom during the period of rising waters in the spring?

A. During that period of rising water in the spring, the silt which is on the bottom is beginning gradually to move, and as it gradually moves the first thing it does is fill up all the dredge cut through the bars and bring the bars up to pretty nearly a fairly level surface on the top. Those bars have been gradually increasing, and I do not think interfere with navigation because the water has gone up so much faster than the bars have gone that they are always getting better water, until the time comes in July or August when the river begins to fall. By that time, in July and August, the water in the Missouri River has got up to the full force. It has begun to tear away the bed of the stream, and has begun to tear away the banks of the stream, and as the river falls it gets away from the banks which it has soaked, and those banks which are soaked and full of water during the high stage, as the water recedes from them they lose the support the water pressure gave them, and they begin to slough off and subside into the river.

As they slide into the river some of this massed material is taken up in suspension, and some of it is rolled along the bottom, and the result is that in the first part of July the Missouri River is full of sediment that is in suspension and silt on the bottom of the river being rolled down. That silt is rolled down stream and emptied out of the Missouri River into the Mississippi. The volume of it is beyond any expectation of anybody who has not looked into it. All the measurements that have been made from time to time to confirm former reports have shown that the volume of such material that rolls out of the Missouri River every year, most of it in July and August, amounts to a volume of 400,000,000 cubic yards. It amounts to a volume which is equal to almost 400 feet depth over a square mile, over 384 feet depth over a square mile of area. As that material is poured out from the Missouri River on the average every year into the Mississippi River above St. Louis and starts on its way down stream, and as it goes down stream during the July and August freshets or floods, as they are dropping it is assisted on the way, it is joined on the way by the material that rolls from the banks and bed of the Mississippi River itself from St.

Louis to Cairo and from Cairo down to Vicksburg and the mouth of the Red River, and all that material is picked up.

Measurements made in the Missouri above its mouth, and measurements made in the Mississippi below the mouth of the Ohio, have shown there is just as much matter going along at Columbus below the mouth of the Ohio as there is at St. Louis below the mouth of the Missouri. So that the river has to be accepted as taking that rolling material, that sediment and silt, all the material in suspension, in mud, you might say, and it is carried all the way down the river. It is deposited from time to time in the eddies of the banks; it is deposited from time to time on the bars; it is picked up again and washed further down from pool to pool and eventually it all goes into the Gulf of Mexico, and shows up either in the extension of the bars or the built up material in the delta of the Mississippi River, running further and further out into the Gulf stream every year.

That has all been checked up and measured, so that it is known that that material is piled up in the Gulf of Mexico in sufficient quantity to justify the statements that have been made that this vast amount of one mile square and 384 feet high is going down the river fresher every year.

Q. What happens to that mass of material going down the river, General, when the river begins to fall in July, August and September?

A. When the river is at full height, flowing with its greatest velocity, all this matter that is in suspension and rolling along the bottom up above St. Louis keeps on going; but at the moment the river begins to fall, its velocity lessens, and the moment the velocity diminishes a lot of that material in suspension and rolling on the bottom stops. The material in suspension settles on the bottom, and that that is rolling stops and lodges on the nearest bar. So that that rapid falling of the river brings on rapid diminution of the nearest bar. So that that rapid falling of the river brings on rapid diminution of the current, piles up a mass of material on these bars, and they apparently rise up from the bed of the river very rapidly, and come

up close to the surface. The first thing that the steamboat men know, of the men in charge of the river improvements, is that there is a report that even though the water is at the stage of 23 above dead low—

Q. At what point?

A. Even as high as 23 of the stage.

Q. What stage?

A. 23 feet on the gauge at St. Louis. There have been cases where it is reported that there is only 8-foot draft over some bar down the river, then the dredges necessarily must start out and rush to that bar, make a cut through the bar, so as to establish a new channel.

Q. How do they determine, General, when the dredges are to start cutting through a channel?

A. They only determine when the dredge is needed by reports as to the depth over these crossings. So always in July, in July and August, the Government boats that are going up the river are always sounding over the bars that have made trouble in former years. Between St. Louis and Cairo there are some forty or fifty places where bars might form. In some years they have actually had to work on from 13 to 20 of them, but there are generally a half a dozen of them that always make trouble, and a half a dozen that generally come to the front as an obstruction quicker than others.

So that Government boats going up and down the river always sound every possible bar crossing, and as soon as they report that they have found a depth on one of these bars of something like ten feet where the project was eight, or eleven feet where the project was nine, then somebody goes down there and if the bar still develops promptly the dredge promptly goes down there and starts to work. It has the result of past years of experience.

So that the channels will be more permanent the cut is made through the bars, and each time they know pretty well at each bar where is the best place to put the dredge to make the new cut through the bar rapidly, and in such position that the river current will scour it out and improve it. Just as soon as the dredge goes in there and

goes to work it does not expect to dredge the full width of the channel. It makes one cut right straight through, perhaps about 30 feet wide, and it goes on and leaves a ridge of about 30 feet and makes another cut, and by the time it has gone along the length of the proposed tunnel the river has itself scoured away all those intermediate ridges, and they have got a good channel established for practically the full width.

And once established, when that opening has been cut through, then the rise of the bars act as a submerged dam, holds the water back and forces the massed material in the stream to go through those artificially deepened cuts, so that the river itself scours out that channel and in a good many cases that dredge never has to go back to that bar during the season. In a good many cases those cuts when made through last entirely through the season, and especially so if the river in dropping drops gradually and steadily. Just as long as the river goes down with a steady drop the dredge cuts made across the bar remain as a rule through the rest of the year.

But if the river drops and then afterwards rises two or three or five or ten feet, and then drops again, the moment it drops the second time all of the former trouble reoccurs. The river in rising that way has helped to pile up material into that cut, and the river dropping has that effect. As the river rises it picks up a whole lot of material itself, and then the moment the river drops again all that material in suspension and rolling on the bottom piles up on that bar and sometimes fills the old cut up, and the dredges have to go back and make a new cut through. Once in a while, not ordinarily, but once in a while it has happened that the dredge had to go back two or three or four times to dredge a cut through some particular bar, simply because there had been three or four rises of the river subsequent to the first cutting of the channel.

Q. At which stages of the river do these bars usually form and the channel usually fill up?

A. At St. Louis, where the work was for an 8-foot stage, there were plenty of cases where an 8-foot bar, as

they call them, would form from 12 up to 18 feet on the gauge. And, as I have just said, they have been known to form at a 23-foot stage on the gauge. So that up to the present time, the moment the river gets down to 20 feet the office is looking out very carefully to see where there is any trouble. At 20 feet they expect to find bars developing somewhere in the stretch between St. Louis and Cairo. Between Cairo and Vicksburg the place which bothers them most is around Columbus, and at a stage of about 13, or 14 or 15 feet the bars begin to build.

Q. That is, that stage of 13 or 14 or 15 feet is on the Columbus gauge?

A. That stage is generally, they generally use the guage at Cairo, but for Columbus they use the gauge at a place that is not far from Columbus, more in the neighborhood of the bars as they regularly form.

Q. As a general rule, do the bars form at low water in the Mississippi River?

A. The bars generally form around the 10 to 20-foot stage at St. Louis, and around the 10 and up to 15-foot stage down below Columbus, and at a stage perhaps a little lower than that down at Vicksburg. The moment they get down to the Red River they have got beyond any bars that trouble navigation.

Q. What stage of the river is best for navigation?

A. The stage of river that would be best for navigation is an intermediate stage. If it were not for the formation of the bars they would be better off on low stages; but as the bars are always sure to be forming somewhere after the river gets below this 20-foot stage, they are much better off at an intermediate stage where there is less danger of bar troubles and where the current is not as severe as at the high stages.

Q. Would you say, General, that a good channel in the Mississippi River depended more upon the volume of water flowing at a particular time or the constancy that a given stage is maintained?

A. The most favorable conditions are where the river is as uniform as possible in its height. If it were not for the floods there would be no trouble in navigation at probably a 10-foot stage.

Q. And the volume of water in itself does not have any particular effect upon a good channel so long as it is constant?

A. The volume of water has almost no effect on the channel. It is the rise and fall of the stage, which in itself means nothing except that there is a greater velocity in the river flow; so it is the change in velocity of river flow that is the cause of a bar, and not the height that is measured on the gauge, not the volume of water that is flowing, which generally is in proportion to the stage that you read off from the gauge. It is not the volume of water; it is not the height of the water in the river; it is the unequal movement of the water in velocity. Wherever the velocity drops there is trouble and a bar develops.

Q. In view of this condition of the Mississippi River and these bars which you have been describing, from your experience in connection with the Mississippi River what, if any, effect would the diversion of 10,000 cubic feet of water per second from Lake Michigan into the Mississippi River have upon its navigable capacity?

A. As I have just stated, a bar forms on a rapidly falling river; and a rapidly falling river means that it may go down 6 inches or a foot in one day. It has been known to go down a foot in one day; and when the river falls a foot in one day there is sure to be a whole lot of trouble in dredging.

Q. If the river falls a foot in one day, say, at St. Louis, about how much change would that be in the volume flowing at that point?

A. At St. Louis it means about twenty to thirty thousand feet per second at the stage at which bars develop. As the river drops and you get down to low water, of course 10,000 feet per second has a different valuation; but at the stage when the dredges have to jump in and cut a passageway through the bar at St. Louis a foot means about 25,000 to 30,000 feet per second.

Mr. Lynde. What stage is that, General?

The Witness. That stage varies. At the 23-foot stage at St. Louis 10,000 second feet is equivalent to a change in—

Mr. Lynde. I do not care to interrupt. I am merely asking what particular stage the witness refers to as the stage when the bar forms.

The Witness. That is anywhere between 15 and 23 feet.

Mr. Lynde. On the gauge at St. Louis?

The Witness. Yes; where you are liable to find the river falling most rapidly.

By Mr. LeBoeuf:

Q. Now, General, will you go back to the question of your opinion as to the effect on the navigable capacity of the Mississippi River of the 10,000 second feet diverted from Lake Michigan.

A. On the capacity of the river?

Q. The navigable capacity.

A. It has virtually no appreciable effect. It may make a difference of half a day in the time when the dredge starts work. After the dredge has once started work that 10,000 feet per second has no more value; and if the river is falling rapidly the 10,000 feet per second effect might be wiped out in a fraction of a day.

Q. So that except for a differenec when the dredges would start work on a forming bar, this diversion would have no appreciable effect on the navigable capacity of the Mississippi?

A. No appreciable effect.

Q. Would it take the dredges any longer to cut through the bars whether or not there was 10,000 cubic feet of water per second additional?

A. Hardly any difference at all, because when a dredge goes to work it knows it has in front of it a falling river, and so it makes a cut through the bar, or endeavors to make a cut through the bar a great deal deeper than the project depth, because the deeper it can make the cut at the start the more quickly will the river take hold and widen and deepen that cut. So that the dredge would make the same cut no matter whether there was 10,000 feet per second more or less there flowing.

Q. And when the channel is finally cut through one of these bars, would it last any longer if there was a Chicago diversion of 10,000 second feet of Lake Michigan water?

A. I do not see why it would, because if the river falls very slowly and very gradually the river itself keeps this cut dredged out beyond the depth that is required for navigation; and if the river does the opposite and does not fall gradually but rises and falls again, the whole work has to be started over again and you have not had any gain from your 10,000 second feet.

Q. And a constant increment, then, of 10,000 second feet would have no effect on the maintenance of these channels?

A. I do not think anybody has ever been able to discover any effect.

The Special Master. The point is, whether you have discovered any effect, General.

The Witness. I have not been able to see any gain.

By Mr. LeBoeuf:

Q. In your opinion, what increment would have to be added to the low water flow of the Mississippi River during the navigation season to maintain a permanent navigable channel of 9 feet from the mouth of the Missouri to the mouth of the Mississippi?

Mr. Dietz. Under what conditions? We object to it unless the conditions are stated. Do you mean the conditions now existing, or the conditions of nature, with improvement or without improvement?

Mr. LeBoeuf. The conditions as now exist in the river today.

Mr. Lynde. And an increment added to how large a volume of water?

Mr. LeBoeuf. The low water flow.

The Special Master. Re-form the question with these additions, not that the General is likely to make any mistake in his appreciation of the question, but just to safeguard the record.

Mr. LeBoeuf. I thought I had them all in, in the first place.

By Mr. LeBoeuf:

Q. Will you state, in your opinion, under present conditions of the Mississippi River, what increment would have to be added to the low water flow of the river during the navigation season to maintain a permanent navigable channel of 9 feet from the mouth of the Missouri to the mouth of the Mississippi?

A. At the low water stage of the season of navigation at St. Louis the volume of the discharge of the river is placed at 40,000 second feet flow.

Mr. Adcock. At the present time, General?

The Witness. At the present time; yes. It used to be at 4 feet on the gauge. Now it is at 1 foot.

Mr. Adcock. That is the low water flow during navigation?

The Witness. The low water flow in the navigation season. It is defined in the Chief of Engineers' report as that stage that gives a discharge of 40,000 second feet.

By Mr. LeBoeuf:

Q. At the St. Louis gate?

A. At the St. Louis gate; and the reason that the gauge is different now from what it used to be is that during these recent years in the general improvement of the river the bed has been lowered, and while the volume that goes through is just the same, of course, as the bottom goes down the water surface goes down, and as the bottom is scoured away some three feet the water surface is three feet lower now at ordinary high water navigation than it used to be. At low water flow it is taken at 40,000 second feet.

In past years they have been fighting for a project of 8 feet. This year Congress has made it 9 feet. While it was 8 feet they found that these bars had developed at St. Louis at a stage sometimes of 23 feet.

If they have got to have a foot more depth in the river it is pretty certain that in future they can expect more

bars to develop in 23 feet than in the past. So today I claim that in order to be sure that you have got 9 feet depth of water in the Mississippi between St. Louis and Cairo you have got to be sure that you have got water enough to keep the gauge up to 23 feet; and when the gauge is 23 feet the water flow discharge has been measured up to 350,000 feet per second. 350,000 feet per second diminished by 40,000 feet per second is 310,000 feet per second, which represents the amount of water that would have to be added to the Mississippi River to be sure that you had 9 feet navigation if you did not have any dredging and did not have any regulation work.

Bixby, Trans. 8065-94.

By Mr. Johnson:

Q. But that is not an answer to the question I asked you, General. I asked you if you did or did not make a certain statement to Colonel Randolph in the presence of Mr. Deitz, and I would like to have an answer to that question.

A. If that question means perfect agreement, I should immediately say no. If it means a partial agreement, I should say yes.

Q. Do I understand it to be your testimony that the Chicago diversion adds nothing to the navigable depths of the channels of the Mississippi during the season of navigation?

A. It adds something to the flow. It has no appreciable effect on the handling of boats, or on the channels. I may not understand the question exactly.

(The last preceding question was repeated by the reporter as above recorded.)

The Witness. I do not think that flow has any appreciable effect on the depths. The benefits on depths are all produced by other causes.

By Mr. Johnson:

Q. You think it is insignificant?

A. I think it is insignificant.

Q. And useless?

A. And useless.

Q. Useless to navigation?

A. Yes. At high water stages they have more water than they want. At medium stages it does not help anything except perhaps a short time while the dredges is getting into position. At low water stages the depths are already there and they do not need any water.

Q. You say appreciable. What do you mean by appreciable? How many inches?

A. Well, I do not think it affects any inches at all within the eight or nine feet of project depth.

Q. At the time that the bars begin to form and to impede navigation, take any particular bar, say the depth over it is three feet; under the condition that you would send a dredge out and at that moment of time if the Chicago diversion were instantly cut off, so that the water from the Chicago diversion were not over that bar, is it your testimony that the water would be the same depth over that bar?

A. If the Chicago diversion were cut off, it would take about a month for the water to get there, and the dredge would get its work done inside of two or three days.

Q. Let us go back to the question again now, and I will state it a little differently. We are imagining a bar that has become troublesome because, we will say, there are only three feet over that bar, and I ask you to imagine that from that three feet were subtracted by some magic incident the effect of the Chicago diversion. Would that depth over that bar still be three feet?

A. Between St. Louis and Cairo it might be six inches; below Cairo it might be three inches, for a very short time.

Q. And you think that six inches under those circumstances is useless and insignificant to navigation? Is that so?

A. I do not think it has any value to navigation at all, because when the dredge is in there the navigation cannot get by the dredge, and it has to wait until the

dredge gets out of the way, and when the dredge gets out of the way they have their seven or eight or nine feet of project depth, and it may make a little bit of difference in time of the dredges getting in there, depending on how fast the river falls, but if the river falls half a foot a day, or if the river falls a foot a day, then the effect of that water is all wiped out in that day before the dredge has an opportunity to open the channel.

Q. But in the case of but six inches over that bar that may be attributable to the Chicago diversion?

A. Yes; I say it might be. I do not think it would be, but I think it might be.

Q. If you do not think it would be, what amount of that three feet do you think would be attributable to the Chicago diversion?

A. Three feet?

Q. Yes.

A. Of the three feet of the depth over the bar?

Q. Yes; three feet.

A. Well, I think it might have some three to six inches for a half a day.

Q. Why do you say half a day?

A. Because of the rapidity with which the river falls.

Q. I do not know of anything in the question about the river continuing to fall, I said at a moment of time.

A. At that moment of time?

Q. Yes.

A. At that moment of time it would not have any effect, because the dredge would be in position and probably the dredge in position in that cut—

Q. The dredge is no part of this assumption.

A. You have that bar just as it is without any dredge in it?

Q. Yes.

Mr. LeBoeuf. At what stage is the river?

Mr. Johnson. I did not state any stage, but I said when bars were beginning to form and becoming troublesome.

The Witness. Well, the stage makes a great deal of difference. If that three foot bar has formed at the 20-

foot stage the river would be so wide that its flow with the little effect in that cut, would not cut any figure.

By Mr. Johnson:

Q. No part of the three feet would be attributable to the Chicago diversion?

A. Such a small quantity—

Q. What quantity? That is not a difficult question to answer, General. It is a quantitative question.

A. I said between three inches and six inches?

Q. Between three inches and six inches?

A. Yes.

Q. Nearer three than six?

A. I would not be able to say. I do not know any engineer that has ever measured it. I do not know anybody who has not measured it who has any sufficient knowledge to be able to detect that difference.

Q. You know what the increment of the river is at that stage, do you not?

A. That is theoretical.

Mr. Danaher. You have not assumed any stage.

Mr. Johnson. I am assuming one now. The witness is assuming one, 20 feet, and we are adjusting ourselves to that.

The Witness. At that 20-foot stage the increment is about 25,000 feet per second, and that 10,000 feet per second would be 10/25ths of that amount at the most.

By Mr. Johnson:

Q. All right: 10/25ths of the increment?

A. Yes. You might get 10/25ths of a foot in stage and then half of that would have escaped on the bar, but any computation in between three inches and six inches is so tied up with the theories and the characteristics of a river flow that I do not think any engineer could come any closer.

Q. You think that when we start to measuring these hydraulic formulae and get down to between three and six inches we had better not draw any conclusions because they would not be accurate enough?

A. On a river that is flowing 200,000 second feet I do not think they know anything about it with any accuracy greater than that.

Q. You think when we get a river up to 200,000 cubic feet per second we do not know anything about the hydraulics that would enable us to function intelligently in a fall between three and six inches?

A. When you get up there you are dealing with only one or one and a half feet of water flow, and the average engineer thinks he is lucky if he gets that close on any proposition.

Q. And the measurement of rivers, generally speaking, is a science? That is so, is it not?

A. Yes, subject to all engineering formula.

Q. And if it were three to six inches you would regard that as in itself as insignificant?

A. I would under those circumstances.

Q. Suppose instead of this being a three foot bar it was a bar that was 8 feet and 6 inches below the surface. Would that give the same result as with 3 feet to 6 inches?

A. The same result momentarily.

Q. Let us prolong our moments. When does it make a different result?

A. The river may change around and rise six inches in the next few hours, or it may drop a foot or so in the next day. If it rises you have a better channel and do not need your water. If it falls you have an increased scour —it may not be a scour but a condition—

Q. So for that reason you think it would not be of any use to navigation?

A. No, because momentarily there is no navigation there.

Q. In the second case, a ship that only drew 7 feet of water could navigate, could it not?

A. Oh, yes.

Q. Why do you say there is not any navigation?

A. I would admit that there might be a chance for navigation once in a long while.

Q. But on account of this fluctuation and uncertainty both above and below the 6 inches you think the 6 inches would not be very good for the purposes of navigation?

A. At that stage?

Q. Of no practical value?

A. At that stage, at the stage when dredges have to go to work; and when dredges do not have to go to work it cuts no figure at all.

Q. You described very graphically yesterday the water coming down the Mississippi River and encountering the Missouri River and there receiving a great burden of silt; and as I understood your testimony, when the river is flowing rapidly it carries a larger quantity of silt than when it is flowing slowly. Is that correct?

A. Generally.

Q. If a stream carrying its maximum quantity of silt that it can carry without depositing receives an inflow of non-silt bearing water, will it carry the silt further in the presence of a sudden drop in its own head than it would if it had not received the clear water?

A. There might be 1 per cent difference or one-half of one per cent.

Q. In what circumstances? I just asked you the general question. I did not ask for any particular figure.

A. If it received a quantity of water equal to its own.

Q. What would happen then, if it received a quantity of water equal to its own? Would it carry the silt further, or in the event of a decrease in its own head would it carry the burden of silt further on account of the introduction of the new water, or would it deposit it, as a rule?

A. It would depend altogether on the cross section of the river, the shape of the cross section.

Q. Why would it depend upon the shape of the cross section of the river?

A. If the river is like the Mississippi, the more volume you put into it the higher the stage is; and the higher the stage is the wider it is between the edges of the water at the banks, and the higher the stage gets the more chance there is for a big volume. If you put in a double volume you might find the cross section of the river increased three times. Then your current would be diminished. If, on the other hand, you might get an increase of current, it would carry the mud and silt along more effectively than before.

Q. Is it altogether a question of increase in current and not at all a question of added volume of water?

A. Added volume of water practically cuts no figure at all except to mean that you cannot have that volume of water in the river without an increased current, and it is the increased current that counts, and it is practically only the time when that increased current has commenced to diminish, so that it does not carry as much silt in suspension and does not roll as much stuff, such as sand and gravel, etc., along the bottom.

Q. Let us assume a stream with a constant current and banks of such a nature that it would not get three times as wide when it took its own volume of water in addition, and add to that stream a volume of water equal to itself. If the head of that stream decreases and it is bearing silt, will it carry that silt further or not than it would if the added water had not been added?

A. How much velocity of current is coming along with that increased volume of water? Is it dropped in there from the skies in rain, or is it sent along down from a supply of some sort, like a river with a high velocity of its own?

Bixby, Trans. 8330-40.

By Mr. Lynde:

Q. General, I think you said in response to a question by Mr. Adcock that you had had occasion in connection with your 1909 report to examine the previous history of the regularization of the river, did you not?

A. Yes.

Q. And that started with the project of 1881. Is that correct?

A. That is the project under which they were working at the time I went there and the time we made that report.

Q. So that we can shorten the matter, it is a fact that since 1881 there have been regular appropriations by Congress of certain amounts of money which have been spent by the Engineer Corps each year for this so-called partial regularization of the river, is it not?

A. Yes.

Q. That is correct, is it not?

A. That is correct.

Q. With the exception of perhaps a few years when there was not sufficient appropriation and there was no expenditure.

A. That is correct.

Q. That is generally correct?

A. That is generally correct.

The Special Master. A case of perfect agreement.

By Mr. Lynde:

Q. General Bixby, turning your mind particularly to the period from 1895 to 1909, at the time you got out your report, can you think of any year, any particular year, when by reason of expenditure by the Chief of Engineers or the Engineer Corps or the Federal Government in any way anything was done which produced a marked change in the navigable channel of the Mississippi River? Do you get the question?

A. Yes. I do not know about those dates, between those years, but there had been a great deal done before 1909 that had benefited the navigation on the Mississippi River.

Q. I am not particular about those dates. Any particular year, we will say, before 1909.

A. Yes. Well, the river was being improved right straight along and its navigation facilities benefited right along.

Q. That is not my question. I want you to answer this specific question. I mean any year that stands out as different from any of the other years, any normal year, in which there was any unusual achievement or change in the channel.

A. I do not remember any.

Q. You cannot think of any particular year?

A. I cannot.

Q. Have you any record that you could refer to? Would your report indicate any particular year?

A. I don't remember just now. I probably knew all about it in 1909.

Q. You are familiar, of course, with the statement contained in the Chief of Engineer's report, are you not?

A. At that time?

Q. Yes.

A. I think I must have been.

Q. Say from 1900 to 1909.

A. I think I must have been.

Q. In that case you are familiar with the statement on page 391 of the report of the Chief Engineers for 1903 which, after giving certain details of expenditure on the regularization of the river, says:

"The result of the expenditure of this amount has been the partial improvement of the entire reach of the river from St. Louis to Cairo. During the past year there were at all times during open navigation a channel depth of 6 feet or more throughout this reach. The river attained a low water stage of 3.5 feet above standard low water."

Do you remember that statement?

A. I do not remember it, but it seems plausible.

Q. General, it is a fact, is it not, that that same statement in that identical language occurred not only in the 1903 report, but in the 1904 and 1905 reports?

A. I should suppose probably.

Q. And the statement agrees with your recollections, does it not?

A. I do not recollect anything different from it.

Q. Does it agree with your recollection? That is the question.

A. If I haven't got my recollection with me, I simply want to state that I do not recollect anything to the contrary.

Q. Let me call your attention to the statement occurring on page 413 of the 1904 report.

A. Yes, sir.

Q. Following exactly the same form as the 1903 report, that is, going into the details of the nature of the expenditures, the report states:

"The result of the expenditure of this amount has been the partial improvement of the entire extent of the river from St. Louis to Cairo."

You will notice that sentence is exactly the same as the sentence in the 1903 report. Then the report says:

"During the past year there was at all times during open navigation a channel depth of 8 feet or more throughout this section."

What occurred in the year 1904 to produce or effect an improvement in the channel?

A. Very probably a 2-foot difference in the channel, if there was that improvement, and that seems to be indicated there, might very easily be taken care of by the difference in rainfall or run-off on the Mississippi and Missouri rivers. In the last two years the difference in run-off from the two rivers, Mississippi and Missouri, has made a difference in navigation.

Q. I do not want to interrupt you, General, but there is no use wasting time about that, because the 1903 report states:

"The river attained a low water stage of 3.5 feet above standard low water."

The 1904 report says:

"The river reached a low water stage of six-tenths of a foot below standard low water."

A. Yes.

Q. So that in 1904, when there was an 8-foot channel, it was a 4 foot lower stage than there was with a 6-foot channel. You would not say that was an explanation of the improvement, would you?

A. I do not get that statement clearly in my mind right now. Please read it.

Q. Here is the statement in the 1903 report:

"The river attained a low water stage of 3.5 feet above standard low water."

That is the lowest point reached that year as I read that language. Is that correct?

A. I know nothing to the contrary.

Q. I mean that is what that means to an engineer, is it not?

Mr. LeBoeuf. Perhaps if you would hand the sheet to the witness it might help him.

A. Perhaps if I could look at it and see the whole sentence, I might be able to answer it.

By Mr. Lynde:

Q. The portions I have read from each report I have marked with a lead pencil in each case. This is the 1903 report and this is the 1904 report. Have you any explanation now, after looking at them?

A. That seems to imply simply that at a very low stage of water they had a greater depth in the channel. If that has happened on the Missouri several times, I would not be surprised if it happened on the Mississippi, just from water flow.

Q. Let me call your attention to the fact, and I will produce the pages if any question is raised about it, that every year after 1904, for I think ten or twelve years, and then they adopted a slightly different formula, but say the same thing in effect, the Chief of Engineer's report again and again used that exact statement, that there was an 8-foot channel throughout the year. And I think you will find there were all kinds of variations in the low stages of the river?

A. Yes.

Q. Assuming that I am correct about that—

A. I agree with that.

Q. Just let me complete my question.

A. All right.

Q. Assuming that after 1904, or year after year, beginning with 1904, that statement was made, that there had been maintained an 8-foot channel, and also the report showed there had been considerable variation of the low water, some low, some high, just as much variation as there was between 1903 and 1904, would not that indicate that the volume of low water had nothing to do with the maintenance of the 8-foot channel?

A. I should say so.

Q. Then once again, I would like to have you say whether you are able to think of anything that occurred during the years 1903 or 1904 or at any time immediately prior thereto which had the effect of changing in one year the channel depth from 6 to 8 feet?

A. As I just said, a difference in rain fall or run-off would easily explain it.

Q. Did it occur to you that the addition of water from Lake Michigan might have some effect? Rainfall means more water, does it not?

A. Rainfall means a great deal more water, several hundred thousand second feet.

Q. That is the only explanation you can give, the difference in rain fall and run-off?

A. No, I should say that the way in which dredges were being handled was a good deal more responsible for it than any question of water supply at that time; that the dredges were in operation and digging these channels all the time, and they were struggling to keep down to the project depth, and they would generally get the project depth before the end of the season and the depths to which the dredges made their cuts through the bars would help determine the depths in the river at the end of the season of navigation.

Q. Is it not a fact that the Chief of Engineers in this matter was summarizing the work of the Engineering Department? There is no mention of this extraneous condition. He is summing up what he has done. He says as a result of previous work in those years the 6-foot channel and a 8-foot channel was obtained. He is not talking about anything except the effect?

A. I should say that was complimentary to the Engineers in charge and the men that were working under him.

Q. You think that is an attempt by the Chief of Engineers to claim for one year's work the credit for a two-foot difference in the channel, do you?

A. No. It is an attempt of the Chief of Engineers to state facts.

Q. The 2-foot difference in the channel resulted from one year's work. Is that a fact?

A. A 2-foot difference in depth would undoubtedly result from some cause, but whether it was water flow or dredging or rainfall or run-off, it would be extremely difficult to tell.

Q. But in spite of that careful investigation that you made in 1909 summing up all previous work in that careful report that you filed, you are unable to think of anything specifically occurring in 1903 when that marked change in channel occurred?

A. The one thing that occurred there more than anything else was that the officer in charge that year was very effective in seeing that his dredges did all the work that the money would pay for.

Q. As a matter of fact, you know that the amount expended in 1903 was less than the amount expended in 1904, do you not?

A. That might easily be so, because some years they spent but half as much as they did in others, although at the present time they are trying to spend a good deal because they are hampered with not having dredges enough.

Mr. Lynde. I think that is all.

Mr. LeBoeuf. If your Honor please, the re-direct examination will be very short, and we can conclude with the witness.

The Special Master. Proceed.

RE-DIRECT EXAMINATION.

By Mr. LeBoeuf:

Q. General, right along the line of Mr. Lynde's questions as to the causes which might make this 2-foot change between those two years, if the cause was water flow, how much would the volume of water flow have to be, in your opinion?

A. For two feet?

Q. To make that change of two feet in channel depth. Approximately how much?

A. Thirty or forty thousand second feet.

SANITARY DISTRICT OF CHICAGO
TABULATION OF FLOW IN SANITARY AND SHIP CANAL.

Year	Total Flow at Lockport	Sewage Flow (Chicago Water Works Pumpage)	Water directly abstracted from Lake Michigan by Sanitary Dist.
1903	4971 C. F. S.	582 C. F. S.	4389 C. F. S.
1904	4793 C. F. S.	618 C. F. S.	4175 C. F. S.

Exhibit 1111. Tr. 3361.

"Q. What is the existing authorized Federal project in that district?

A. Nine feet deep and three hundred feet wide.

Q. When was that adopted?

A. I haven't the law here. It was approved by the President January 21st of this year. I think my memory is accurate on that.

Q. Was that a modification of an existing project?

A. Quite.

Q. Rather than a new project.

A. Absolutely.

Q. And the modification applied to your method of improvement rather than to change in depth, did it not?

A. It meant a change in depth, too. General Ernst's project of 1881 at one time was 9 feet, for a period of three or four years, and 250 feet wide, in 1903. From then on it was 8 feet deep and 250 feet wide. My review and recommendation was for a channel 9 feet and 300 feet wide, including extending those works to the northern boundary of St. Louis.

Q. And none of these projects depended upon the Chicago diversion?

A. No, sir. They were made in 1881, some of them.

Q. The later ones did not depend on that?

A. It was not considered by me."

Gotwals Transcript 5685-5686.

HOUSE OF REPRESENTATIVES

63rd Congress, 2nd Session — Document No. 762.

FINAL REPORT, WATERWAY FROM LOCKPORT, ILL., TO THE MOUTH OF THE ILLINOIS RIVER.

"WAR DEPARTMENT,
Office of the Chief of Engineer
Washington, February 17, 1914.

* * * * *

'VII THE INFLUENCE ON VOLUME AND HEIGHT OF WATERS IN THE MISSISSIPPI RIVER BELOW CAIRO.

11. The influence on the volume of the Mississippi River due to any diversion from Lake Michigan will be an increase approximately equal to the amount of water diverted. The effect upon gauge height will be small even at low stages, and at high stages it would scarcely be appreciable and not of any importance.' (p. 7)

'FINAL REPORT BY A SPECIAL BOARD OF ENGINEERS ON WATERWAY FROM LOCKPORT, ILL., TO MOUTH OF ILLINOIS RIVER.

New York City, August 15, 1913.

From: A Special Board of Engineers.

To: The Chief of Engineers, United States Army.

Subject: Report of waterway from Lockport, Ill., to the mouth of Illinois River, and on certain related subjects.' (p. 9)

'VII The influence on volume and height of waters in the Mississippi River below Cairo.

This subject is specially discussed in Appendix B.

The influence on the volume of the Mississippi River due to any diversion from Lake Michigan will be an increase approximately equal to the amount of the diversion, since the losses due to evaporation and other causes will not be large, and at extreme high water the increase due

to a 5,000 second-foot diversion, will be less than one-third of 1 per cent from Cairo to the mouth of the river.

Except as increase in volume results in increase of gauge height or depth of water available for purposes of navigation it will be of no importance within any limits of diversion heretofore considered as permissible.

The effect of any diversion upon gauge height will always be small, and at the highest stages practically nothing, but the exact effect at any time or at any stage can not be determined, since this effect will be complicated or obscured by various other changes in the regimen of the river."

Exhibit 171.

House Doc. 762, 63rd Congress, 2nd sess.

"New York, August 13, 1913.

Brig. Gen. William H. Bixby,

President, Lakes to Gulf Waterway Board.

SIR: I have the honor to submit the following report upon the influence on volume and height of waters in the Mississippi River below Cairo by reason of any diversion of water from Lake Michigan for the maintenance of the proposed Lakes to the Gulf Waterway.

The influence in volume of any diversion from Lake Michigan will be an increase in discharge approximately equal to the amount of the diversion, since the losses due to evaporation and other causes will not be large. At ordinary low water the percentage of increase in the volume of discharge due to the present authorized diversion will vary from about 2½ per cent at Cairo to 1½ per cent at New Orleans, and at extreme high water will be less than one-fourth of 1 per cent from Cairo to the mouth of the river.

Except as increase in volume results in increases of gauge height or of depth of water available for purposes of navigation, it will be of no importance within any limits of diversion heretofore considered as permissible.

The effect of any diversion upon gauge height will always be small, and at the highest stages practically nothing, but the exact effect at any time or at any stage is impossible to determine, since this effect will be complicated or obscured by various other changes in the regimen of the river."

* * * * * *

"The increase of navigable depths at lower stages due to any diversion would be less than indicated by the theoretical increase in gauge height, for elevation of the surface of the river has been found to be accompanied by a corresponding, though smaller, elevation of its bed.

In the Report of the Board of Engineers on Survey of Mississippi River from St. Louis, Mo., to its mouth, published in House Document No. 50, Sixty-first Congress, first session, page 44, it is stated as follows:

Repeated measurements (see graphical plot hereto appended) on the bar crossing of the Mississippi between St. Louis and Cairo show that up to a stage of about 20 feet above low water the available depth across the new bar is increased on an average only about one-half foot for every foot in the rise of water. (Between Cairo and Red River similar measurements show even less increase in navigable depth per foot of rise of water surface.)

Due to the permanent character of the diversion, the above ratio of elevations of water surface and river bed would not hold, and any permanent increase in gauge height would be less than that indicated by the standard curve, and would represent a change in the regimen of the river which would be accompanied by a rise of the river bed practically equal to such increase. In any case, the gain in navigable depth would be insignificant for any permissible diversion.

Very respectfully,

J. B. CAVANAUGH,

Major, Corps of Engineers."

Exhibit 171.

House Doc. 762, 63rd Congress, 2nd sess.

"The other States on the Mississippi have but a theoretical interest in the Chicago diversion. The aid which it affords to low-water navigation is very small above the mouth of the Missouri River and trifling below that point. The additional height of floods which it causes is of no practical importance.

Warren Report,
Enrichment of Miss. R. by
Chicago diversion
Par. 175 on Page 98."

Exhibit 175.

"REPORT ON THE
SANITARY DISTRICT OF CHICAGO

War Department,
Office of the Chief of Engineers,
Washington, April 18, 1924.

Subject: Diversion of water from Lake Michigan by the Sanitary District of Chicago.

Memorandum for the Secretary of War:

* * * * *

NAVIGATION ON THE MISSISSIPPI RIVER

The low-water widths of the Mississippi River immediately below the mouth of the Illinois are between 1,500 and 2,000 feet; at bankfull stages the widths are between 2,500 and 4,500 feet. Under present conditions the estimated extreme low-water flow is about 30,000 cubic feet per second including that diverted from Lake Michigan. (See H. Doc. No. 2, 67th Cong. 1st sess.)

The diversion of 8,000 second-feet from the lake constitutes slightly over one-fourth of the low-water flow in the Mississippi River. An inspection of the discharge curve of the river at St. Louis indicates that an increment of 8,000 cubic feet per second produces an increased depth of 1.4 feet (Plate VIII). No other discharge curves are available for that portion of the river between Grafton and Cairo.

It would not be unwise to assume that the average raising of the water surface amounts to about 1 foot, but due to the hydraulics of the Mississippi River, where the elevation of the tops of the bars fluctuates with the height of the surface of the water, it is doubtful if the actual depths are materially increased. For this reason it is impossible to evaluate the benefit if there is any."

Exhibit 176.

Excerpt from Report of Major Putnam,
U. S. District Engineer, November 1923.

COMMITTEE ON RIVERS AND HARBORS
HOUSE OF REPRESENTATIVES, U. S.

"69th Congress
1st Session

Document
No. 4.

ILLINOIS RIVER, ILL.

LETTER
FROM THE
CHIEF OF ENGINEERS, UNITED STATES ARMY
TRANSMITTING
REPORT OF THE BOARD OF ENGINEERS FOR RIVERS AND HARBORS ON ILLINOIS RIVER, ILL.

* * * * *

104. It would not be unwise to assume that the average raising of the water surface amounts to about one foot between Grafton and Cairo; but due to the characteristics of the Mississippi River, where the tops of the bars seem to rise with the surface of the water, it is doubtful if the actual depths are materially increased. For this reason it is impracticable to evaluate whatever benefit exists." (p. 240)

Exhibit 177.

APPENDIX "N."

(Document No. 42 of Complainants' Exhibit No. 12)

"THE SANITARY DISTRICT OF CHICAGO

910 So. Michigan Avenue,
January 31, 1925.

Honorable John W. Weeks,
Secretary of War,
Washington, D. C.

Sir:

"The Sanitary District of Chicago hereby applies for permission to divert an annual average of ten thousand cubic second feet of water from Lake Michigan through the channels of the Sanitary District of Chicago, for the purpose of preserving the lives and health of all of its people, and of the millions of others in constant, daily contact with them.

"We have prepared a brief statement of fact in support of this application, which we present herewith for your consideration, all of which is respectfully submitted.

"Yours very truly,

"SANITARY DISTRICT OF CHICAGO,
By LAWRENCE V. KING,
President.

ALEX N. TODD,
JOHN K. LAWLER,
MORRIS ELLER,
AUGUST W. MILLER,
T. J. CROWE,
JAMES M. WHALEN,
FRANK J. LINK,
MICHAEL ROSENBERG,
Trustees.

EDWARD J. KELLY,
Chief Engineer."

"Attest:
HARRY W. WALLACE,
Clerk."

Tr. 417-418, Doc. 42, Ex. 12.

REPORT OF MAJOR PUTNAM TO CHIEF OF ENGINEERS.

"U. S. Engineer's Office, Chicago, Ill., March 2, 1925.

To the Chief of Engineers, Washington, D. C.

"1. This is an application from the Sanitary District of Chicago, a municipality created under the laws of the state of Illinois, to divert 10,000 cubic feet per second of water from Lake Michigan, for the purpose of keeping the sewage of that locality from contaminating its water supply and for reducing the sewage by dilution.

"2. This question of the diversion of water from Lake Michigan has been so thoroughly investigated by the Department and discussed at such great length in various reports that it is not believed advisable to enter into any description or historical review before presenting the recommendations which are to follow. Detailed information of this character may be found in the report entitled 'Diversion of Water from Lake Michigan,' which was submitted by this office on November 1, 1923.

"3. This application is prompted by the action of the United States Supreme Court on January 5, 1925, by which it sustained the position taken by the local United States Court requiring adherence to the limitations placed by the Secretary of War on the amount of the diversion. The local authorities are faced with the alternative of a reduction in the amount of diversion to 4,167 cubic feet per second by March 15, 1925, or relief from Congress or the War Department.

* * * * *

"12. Condition (3) is considered necessary to permit an ultimate reduction of the diversion to 4,167 cubic feet per second. Controlling works of some sort will be required to keep the Chicago River from discharging into Lake Michigan in times of flood, and at least two types have been suggested which are believed to be practical.

"13. The provision with reference to metering of the water service of the city of Chicago is included for three reasons:

"(a) There will be a substantial saving in the cost of construction and operation of sewage treatment plans due to the decreased amount of sewage to be treated.

"(b) There will be substantial reduction in the amount of lake water used for domestic purposes.

"(c) It will be possible for the city of Chicago to finance a filtration system for its water supply when its water consumption is reduced to a reasonable amount. When the water supply is filtered, the dangers incident to an occasional reversal of the Chicago River will be entirely eliminated.

"14. A shorter time limit for the permit is not recommended, as results produced by the end of 1927, for instance, will not permit a reduction in the amount of the diversion which it is believed should be required in any renewal, no matter when it is made. Furthermore, sufficient performance can not be prescribed for a shorter period to insure completion of a larger program looking to a reduction in diversion to 4,167 cubic feet per second by 1935.

(Signed) RUFUS W. PUTNAM,
Major, Corps of Engineers,
District Engineer."

Ex. No. 12, Doc. 43, Tr. 418-19, 427-428.

"RECOMMENDATION OF CHIEF ENGINEERS.

March 3, 1925.

"To the Secretary of War:

"1. The Sanitary District of Chicago has made application for a permit to divert an annual average of 10,000 cubic feet per second from Lake Michigan through the channels of the Sanitary District.

"2. The District Engineer recommends the issuance of a permit, covering a period of five years, to divert through the main drainage canal and auxiliary canals of the Sanitary District, an amount of water not to exceed an annual average of 8,500 cubic feet per second; the instantaneous maximum not to exceed 11,000 cubic feet per

second, such permit to be subject to certain conditions set forth in the first indorsement hereon.

"3. The first condition recommended by the District Engineer provides for the adoption and execution of a program of construction of modern sewage disposal plants at such a rate as to provide before the end of five years for treatment of the sewage of a human population of 1,200,000. This figure is believed to be the maximum practicable under existing conditions, and the proposed construction is the first step in a program which will permit the ultimate reduction of the amount of water diverted to 4,167 cubic feet per second, or lower, as treatment plants are installed.

"4. The program of construction recommended is limited to five years, as it is not possible to predict what advances may be made in the science of sewage disposal during the next five years. It is entirely within the realms of possibility that during that period such advances may be made as to warrant the Department's insisting on an even more rapid rate of progress thereafter, should a renewal of this permit be sought. A shorter period for the permit is not believed advisable, as it would be difficult to prescribe sufficient progress in the way of construction of sewage treatment plants and require a substantial reduction in the diversion upon the renewal of the permit.

"5. It is estimated that the construction of sewage treatment plants for a population of 1,200,000 will permit a reduction in the necessary diversion from Lake Michigan of about 1,250 cubic feet per second. In other words, such construction would permit a reduction in the authorized diversion, by December 31, 1929, to about 7,250 cubic feet per second. As stated above (paragraph 4), it is probable that a still more rapid rate of reduction of diversion may be practicable thereafter.

"6. It is, of course, highly desirable that the excessive diversion of water from Lake Michigan be reduced to reasonable limits with the utmost dispatch. For humanitarian reasons, it is impracticable to make the desired reduction instantaneously, and it is believed that the procedure proposed by the District Engineer is the most reasonable and just to all concerned that can be adopted.

"7. As further means of relieving the present undesirable situation with respect to lake levels, the District Engineer recommends as conditions of the permit the prompt adoption and execution of a program for metering Chicago's water supply, the construction of controlling works to prevent the discharge of the Chicago River into Lake Michigan in times of heavy storms, and also that the Sanitary District be required to pay a share of the cost of such regulating or compensating works for restoring lake levels as may be constructed, posting a bond of $1,000,000 as a guarantee of their good faith in the matter.

"8. I concur in the views of the District Engineer, and recommend the issuance of a permit in accordance with the draft herewith.

H. TAYLOR,

Major General, Chief of Engineers."

Ex. No. 12, Doc. 44, Tr. 429-431.

"LETTER OF SECRETARY OF WAR WEEKS TO SANITARY DISTRICT

March 3, 1925.

"Mr. Lawrence F. King,
President, Board of Trustees,
Sanitary District of Chicago,
910 South Michigan Avenue,
Chicago, Illinois.

"Dear Sir:

"With reference to your application of January 31, 1925, for permission to divert an annual average of ten thousand cubic feet of water per second from Lake Michigan through the channels of the Sanitary District of Chicago, it is my pleasure to inform you that after careful consideration by the Chief of Engineers and myself, and acting upon his recommendation, I have issued a permit, effective this date, authorizing the temporary withdrawal of 8,500 cubic feet of water per second until December 31, 1929. One copy of this permit is transmitted herewith.

"Your attention is invited to the conditions to which this authorization is subject, particularly those prescribing certain definite accomplishments on the part of your locality. This department has always held and continues to hold that the taking of an excessive amount of water for sanitation at Chicago does affect navigation on the Great Lakes adversely, and that this diversion of water from Lake Michigan should be reduced to reasonable limits with utmost dispatch. I appreciate that the desired reduction can not be made instantaneously, but with a view of making a substantial reduction by the time this permit expires, the conditions require, among other things, the artificial treatment of the sewage of a large population, the construction of controlling works to prevent the discharge of the Chicago River into the lake, and the metering of the water service of the city of Chicago.

"I cannot emphasize too strongly the importance of diligent and prompt execution of the conditions imposed. If it is necessary to increase the bonding power of the Sanitary District from three to five per cent of the assessed valuation of the taxable property, or if increased taxing power is imperative, the requisite legislative permission should be obtained promptly. While it is not in my province to dictate, I sincerely urge the reduction of your expenses to the lowest possible requirements, and, further, that arrangements be made with the packers and corn products interests to treat their waste before discharging it into the sewers.

"I believe that steps should be taken which will enable Chicago to complete the entire work within ten years.

Sincerely yours,

(Signed) JOHN W. WEEKS,
Secretary of War."

Ex. 12, Doc. 46, Tr. 436-37.

"Mr. Henry G. Chilton, C. M. G.,
Envoy Extraordinary and Minister Plenipotentiary,
Charge d'Affaires ad interim of Great Britain.

"Sir:

Referring further to your note No. 467 of May 7, 1925, concerning the diversion of water from Lake Michigan by the Sanitary District of Chicago, I have the honour to furnish you with the following information in reply to the inquiries made by the Canadian Government.

"First: The actual average flow of the water passing Lockport during the year ending March 3, 1925, has been 9,700 cubic feet per second.

"Second: This average flow of water passing Lockport will not be immediately reduced by any amount under the terms of the permit issued by the Secretary of War on March 3, 1925.

"Third: This average flow may be reduced by December 31, 1929, by an amount varying from 1,750 to 3,000 cubic feet per second.

"By way of explanation of the wide range over which the amount of reduction by December 31, 1929, varies, it should be stated that the amount of reduction depends upon the decrease in the sewage load on the water in the Drainage Canal. The permit prescribes that a minimum population of 1,200,000 be provided with the equivalent of 100% treatment. The program of sewage treatment plant construction contemplates the completion of plants which will give 100% treatment to a population of slightly over 1,400,000. If this program is carried to completion a larger reduction may be made in the flow than if only the requirements of the permit are carried out.

"Furthermore, when the controlling works which are required to be placed in the Chicago River or Drainage Canal to prevent reversals into Lake Michigan in times of flood are completed and in operation it may be found practicable to make a much larger reduction in the flow of water with safety to the water supply of the City of Chicago

during winter season, a time when the oxygen content of the diluting water is much higher than it is during the summer season.

"It is also expected that there will be a substantial reduction in the amount of water consumed in the locality for domestic purposes as the result of a requirement of the permit of March 3, 1925, which makes it necessary for the City of Chicago to adopt and carry into execution a program of metering its water supply. By December 31, 1929, this reduction will vary between 400 and 600 cubic feet per second.

"The net result of all these varying influences will be to make it possible to reduce the average flow by a minimum amount of 1,750 cubic feet per second, and possibly by the maximum amount of 3,000 cubic feet per second.

"To explain the apparent inconsistency between the amount of water specified in the permit (8,500 cubic feet per second measured at the intakes) and the flow at Lockport (9,700 cubic feet per second) it might be stated that the difference represents the amount of domestic water consumption by the City of Chicago which could not be authorized or included properly in a permit issued to the Sanitary District of Chicago, a separate municipality, other than to make the permit non-operative in case of failure on the part of the former agency to adopt certain measures of conservation which were specified. Condition 8 of the permit of March 3, 1925, looks to a substantial reduction of this portion of the flow in the Chicago Drainage Canal, at the same time condition 4 makes possible a reduction in the amount of water used for dilution of sewage.

"Accept, Sir, the renewed assurances of my high consideration.

"*For the Secretary of State:*

"JOSEPH C. GREW."

Ex. 17. Tr. 438-39-40.

Diplomatic Correspondence between the United States and Canada.

"November 24, 1925.

"His Excellency
The Right Honorable
Sir Esme Howard, G.C.M.G., K.C.B., C.V.O.,
Ambassador of Great Britain.

"Excellency:

"Referring further to your Embassy's note No. 813 of September 15, 1925, bringing to my attention certain remarks and inquiries of the Canadian Government in regard to the diversion of water from Lake Michigan by the Sanitary District of Chicago, I take pleasure in submitting the following statements:

* * * * *

"* * * The case before the Secretary of War for action involved the granting of a permit for diversion of water for sanitary purposes only, and the instrument of authority was worded accordingly.

"On the other hand, it seemed to the Secretary of War that the diversion of water for domestic consumption by the City of Chicago was larger than it should be, and that the amount wasted was not a negligible portion of the gross diversion. He also considered that this excessive diversion for domestic purposes made the cost of sewage treatment plant construction and operation unnecessarily high and consequently added to the length of the construction period and the difficulties of financing. For these reasons the Secretary of War took cognizance of the diversion for which the City of Chicago is responsible, in a restrictive way, rather than by permissive means, and included a condition in the permit making the instrument voidable in case the City of Chicago fails to take specified steps looking to a curtailment in the amount of water diverted for domestic purposes.

"In the judgment of the Secretary of War the average diversion which should be authorized for sanitary purposes under the conditions known to exist should not be less than 8,500 cubic feet per second. The safety of the lives and health of citizens of the locality cannot be disregarded,

and until the conditions of the permit of March 3, 1925, have been complied with no substantial reduction in the amount of diversion could be made without endangering health if not life.

"The expression 'measured at the intakes,' used to designate the place where the total actual flow should not exceed that specified in the permit, is hypothetical as it is impracticable to measure the diversion at the numerous intakes with accuracy. For this reason, the practical enforcement of the limitation placed upon the diversion will be carried out at Lockport. Measurements taken there will determine the gross diversion, sanitary and domestic, and, as accurate information is available in regard to the amount of water pumped by the City of Chicago for domestic purposes, the sanitary diversion may be computed by subtracting the domestic diversion from the gross flow at Lockport.

"The term 'diversion' as used in the permit is construed to include the discharge of the Chicago and Calumet Rivers. In view of the methods employed in computing the amount of the diversion the discharge of these streams will be included within the 8,500 cubic feet per second authorized by the permit of March 3, 1925.

* * * * *

"The Canadian Government is correct in concluding that no immediate reduction in diversion has been provided, but its conclusion that no definite reduction is assured and that the effect of the permits will actually be to authorize a greater diversion than is now being made cannot be confirmed. The *gross flow* at Lockport will not exceed an average of 9,700 cubic feet per second, and by the time the permit of March 3, 1925, has expired the gross flow may be reduced to 8,000 cubic feet per second and probably to 6,700 cubic feet per second. The sewage treatment program of the Sanitary District has been arranged, so as to make it possible to effect a reduction to a gross flow of 4,167 cubic feet per second by the year 1935 or before.

"I shall be grateful if you will cause the foregoing statements to be brought to the attention of the Canadian Government.

"Accept, Excellency, the renewed assurances of my highest consideration.

(Signed) FRANK B. KELLOGG."

Ex. 17. Tr. 441, 443, 444-445.

Diplomatic Correspondence between the United States and Canada.

PUTNAM REPORT, PAGES 4, 5 AND 6.

"On March 23, 1908, the Attorney General of the United States caused to be filed in the United States Circuit Court, Northern District of Illinois, Eastern Division, a bill of complaint, No. 29019, seeking to enjoin the Sanitary District of Chicago from constructing the Calumet Sag Canal, diverting through it the waters of Calumet River or Lake Michigan and reversing the current in the Calumet River.

It was alleged by the Government that these acts would lessen, impede, and obstruct navigation in the navigable Calumet River and would lower the level of Lake Michigan and thus decrease its navigability, and therefore were unlawful under section 10 of the river and habor appropriation act of March 3, 1899, because they had neither been authorized by Congress nor recommended by the Chief of Engineers, United States Army, and approved by the Secretary of War.

The respondent answered, denying or belittling each allegation, denying that the Calumet River was navigable within the meaning of the term, or that diverting water from Lake Michigan would lower the level, or that the act of March 3, 1899, was applicable or even a constitutional or valid enactment. At the same time the respondent claimed the project would benefit navigation; that State Law required it to carry out the project; that it was the

only authorized agency for providing the needed drainage and sewerage, and the proposed method was the only lawful one under state enactment; that it made application to the Secretary of War for a permit only as a mere matter of comity; and that the old Illinois and Michigan canal laws constituted authorization by Congress. This answer was filed March 23, 1908.

Evidence of the complainant was taken from February 15, 1909, to July 8, 1909. The defendant proceeded to again open negotiations with the War Department and did not for a time make testimony on its own behalf. The Government testimony was directed to the questions of the effect of the diversion upon the navigation capacity of the lakes and their connecting waters, and the resulting injury to the interests of navigation. When, finally, on May 31, and June 1, 1911, the defendant took testimony, it was not directed toward meeting the testimony of the Government witnesses, but rather to establishing the desirability of the project from a sanitary standpoint and to showing that while there were other efficient methods for the disposal of the sewage of the Calumet district, the proposed dilution method was the cheapest.

Thereupon the case rested while the defendant again negotiated with the Secretary of War. On March 18, 1913, the defendant renewed taking its evidence.

On October 6, 1913, because of the refusal of the defendant to comply with the terms of the permit of the Secretary of War respecting the diversion through the Chicago River, the Attorney General caused another bill, equity No. 114, to be filed in the same court, praying that the defendant be enjoined from diverting more than 4,167 cubic feet of water per second from Lake Michigan through the Chicago River.

The two suits were consolidated and heard as one, and the taking of evidence, begun on March 18, 1913, was continued until its final completion on December 19, 1914. Altogether, a large number of expert witnesses were called on each side. The arguments of counsel on the law and facts were presented in 1915.

On June 19, 1920, Federal Judge Landis rendered an oral opinion in the case, which was in effect a finding that the United States was entitled to an injunction restraining the Sanitary District from diverting more than 4,167 cubic feet of water per second from Lake Michigan. Very shortly after this oral opinion was rendered the defendant filed a motion for its reconsideration, July 10, 1920. The court heard the motion on July 12, 1920, and asked both parties to submit authorities.

Federal Judge Landis resigned his position in March, 1922. Upon representation of the United States attorney the case was transferred to Judge Carpenter, who asked that the complainant submit a brief covering the points brought out by the defendant's motion on July 10, 1920. Briefs were submitted, counter proposals offered and rebutted, and after several hearings before the Federal Judge a formal decree was entered on June 18, 1923, findings against the Sanitary District of Chicago and in favor of the Federal Government. (See Appendix X) The court granted a stay of execution of six months for the purpose of allowing the defendants ample time to seek relief from the Supreme Court of the United States or from Congress. The Sanitary District filed an appeal on June 20, 1923.

As a result of its disregard of Federal jurisdiction the Sanitary District has rendered null and void the permits issued for the construction of the Calumet Sag Channel and the construction and operation of the North Shore Channel. Both permits contained the condition that the total diversion of water from Lake Michigan into the Illinois River, should be no greater than already authorized by past War Department permits. As the amount withdrawn has exceeded the amount thus authorized, the permits are null and void, and the structures are illegal.

On November 9, 1921, a resolution was introduced in the House of Representatives, being entitled 'A bill to limit the amount of water which may be withdrawn from Lake Michigan by the Sanitary District of Chicago, giving authority therefor, and fixing the conditions of such withdrawal.' This resolution obviously was drawn up by or

for the Sanitary District, the object being to obtain congressional authorization for a diversion of 10,000 cubic feet per second. The Secretary of War, upon being consulted by the Committee on Rivers and Harbors, advised against the passage of the enactment in a letter of February 2, 1922. His recommendations are set forth clearly in the following extract from the letter referred to:

The diversion of a certain quantity of water is necessary at present for the proper protection of the health of the citizens of Chicago. It is by no means established, however, that the quantity required for that purpose, either now or in the future, is 10,000 cubic feet per second. I regard it as inadvisable to permit the diversions in that amount, or in any amount exceeding the amount now fixed by the department without full and complete information concerning the necessity therefor. It is my view that the quantity authorized should be limited to the lowest possible for sanitation, after the sewage has been purified to the utmost extent practicable before its discharge into the sanitary canal. I regard it as extremely inadvisable to grant the city of Chicago, or any other agency, the right in perpetuity to take from the lake a definite quantity of water. It is not improbable that within a generation a method may be found to separate the valuable fertilizing elements from sewage as a consequence of which, the withdrawal of water from the lake to dilute the sewage will no longer be necessary. In view of the substantial and widespread damage done to many activities throughout the United States by the diversion, damage which can be but partly compensated for by the construction of the works proposed in the bill, the diversion should not be continued beyond the time when its necessity ceases to exist.

A bill was presented to Congress on January 27, 1923, shortly before the closing of its last session, modifying the terms of the House resolution of November 9, 1921, and including provisions for a 9-foot waterway from Utica to Cairo, Ill., by way of the Illinois and Mississippi Rivers. These provisions serve to make the measure more attractive to residents of towns along the Illinois River, but do

not alter the primary object of the legislation—that of obtaining congressional authority for a diversion of 10,000 cubic feet per second. This bill is to be reported on by a special committee of the Senate at the next session of Congress."

. . . . . .

Ex. 1-G, Tr. 414-15.

Report of Major Putnam, U. S. District Engineer, November 1923.

APPENDIX "O."

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Exhibit 1-G, Trans. 414-15.

Report of Major Putnam, U. S. District Engineer, November 1923.

Question 6 (D):

Without considering compensation by the present relative diversions of water from the Niagara River and from Lake Erie and without prejudice to a future consideration thereof, what works, if any, could be constructed to recover on the St. Lawrence River the amounts of power determined under section 6 (c), and what would be the cost of such works?

244. Answer.—The board finds that after the St. Lawrence River has been fully developed for power production no works can be constructed which would recover on the St. Lawrence the power lost by the diversion of water from the watershed.

Exhibit 147, page 44, 6 (D).

REPORT OF JOINT BOARD OF ENGINEERS ON ST. LAWRENCE WATERWAY.

Evidence with respect to compensating works in the Great Lakes was admitted over objection of complainants.

Transcript 3990-177 to 3990-182; 3903-3904; 5702.

APPENDIX "P."

"Q. Was there any complete sewage treatment at Cleveland during that time?

A. Cleveland has no complete sewage treatment up to the present time. Only a small portion of the sewage is treated.

Q. Does the sewage pass into the lake?

A. The sewage passes into Lake Erie.

By the Special Master:

Q. In what state?

A. In a raw state, with an exception of a small portion of it."

Rockwood, Transcript 8187-8188.

"Q. In your opinion, are there other ways of protecting the public water supply of the city of Chicago and the public health which are equally or more effective than the one of diversion?

A. There are.

Q. Will you explain your reasons for disagreeing with the conclusion reached by Dr. Evans in the statement quoted?

A. I am basing my opinion on the Cleveland experience. In Cleveland the sewage is returned to the Lake only a small portion treated, and the lake is used for a source of supply of water. We do not nor could we, practice diversion of the sewage. Our general death rate, nevertheless, has remained consistently lower than the death rate of Chicago in recent years, and the typhoid rate has remained practically identical with the city of Chicago. On this account I conclude that Chicago could duplicate the Cleveland performance."

Rockwood, Transcript 8209.

"60% water supply filtered 100% chlorinated April 1918
Operation of sewage treatment works started 1922
100% filtration 100% chlorination October 24th, 1925."

Exhibit 190.

Chart "Typhoid Fever Death Rate
Per 100,000 population
Cleveland, Ohio"

"Q. Is the Milwaukee Sewage Plant one of those under your jurisdiction in your official capacity?

A. It is.

Q. Are you familiar with the plant, its operation, and the results that have been secured?

A. I am."

Baker Transcript 8557.

"Q. When did the plant go into operation?

A. I believe the plant went into operation—well, a part of the plant went into operation, I believe, in 1925. I do not recall definitely the date."

Baker Transcript 8560.

"Q. What is the largest water filter plant?

A. Racine.

Q. What other filter plants have you in Wisconsin?

A. Kenosha is probably the next in size—no; I guess Superior is about the same—Kenosha, Superior—I had better take these through in order rather than to miss some.

I will take them in order and not with reference to size. You have asked a general question."

Baker, Transcript 8812.

"Now, Mr. Eddy, you stated that Milwaukee started experimenting in 1914.

A. That is my recollection, yes.

Q. They had built and completed a plan or a design for what number of people?

A. I think about 600,000 plus.

Q. Was it not designed for a somewhat larger population than is presently in the Milwaukee metropolitan area?

A. Not very much. It may have been slightly. It was laid out with a view to enlargement.

Q. Yes. And that was completed in 1925?

A. No. It is not completed now. It was put into partial operation in 1925, but is far from completion now."

Eddy, Transcript 5305-5306.

"The Witness. I might add, just for the purpose of convenience for the record, that, so far as I know, from recently collected data with reference to that table, that in the Lakes Region, in Minnesota, there is one small plant; in Wisconsin there are six plants, the largest of which is Milwaukee. In Illinois, we have on the Lakefront, on the north of the Sanitary District, four plants, on a smaller population. In Indiana, there are no plants on the waterfront. In Michigan, there are two, on Lake Michigan, both on small places, and in Ohio there are three, in the smaller towns, including, however, the work at Cleveland, on a varying degree of treatment."

Pearse, Transcript 4992.

"TYPHOID FEVER DEATH RATE PER 100,000 POPULATION IN CITIES OF OVER 100,000 POPULATION.

Name of City	Population in 1920	Source of Water Supply	Purification of Water Supply
Buffalo	506,775	Lake Erie	Rapid sand filtration and chlorination
Detroit	993,678	Detroit River	Rapid sand filtration and chlorination
Milwaukee	457,147	Lake Michigan	Chlorination
Rochester	295,750	Hemlock Lake	Chlorination"

Exhibit 1178.

APPENDIX "Q."

"Section 5. That the said sanitary district of Chicago is hereby authorized to construct all such dams, water-wheels and other works north of the upper basin of the Illinois and Michigan Canal as may be necessary or appropriate to develop and render available the power arising from the water passing through its main channel and any auxiliary channels now, or hereafter, constructed by said district.

Section 6. That the power made available by the works constructed under the provisions of this act shall be converted into electrical energy, and shall be transmitted to the various cities, villages and towns within said sanitary district, or adjacent to the main channel of said sanitary district, and may be used in the lighting of said cities, villages and towns, or parts thereof, or for the operation of pumping plants or machinery used for municipal purposes or for public service, or may be disposed of to any other person or corporation, upon such terms and conditions as may be agreed to by the said sanitary district: Provided, however, that it shall be the duty of said sanitary district to utilize so much of said power as may be required for that purpose to operate the pumping stations, bridges and other machinery of said sanitary district."

Exhibit No. 14 Section 5, 6. Act of Legislature of Illinois, approved May 14, 1903, p. 49.

"Reading from Exhibit 1 E, being page 11, first paragraph of the Putnam Report:

'In 1903 work was started on an extension of the main channel leading from the basin at the controlling works to the proposed site of the power house, some 11,000 feet. This work, including the construction of the power house, the installation of the machinery, and the completion of the transition lines and the tail race was finished in the latter part of the year 1907. From the power house the channel was extended to the upper basin at Joliet, some

11,000 feet, to provide for carrying away the outfall from the power house and discharging it into the Des Plaines River."

Exhibit 1-E p. 317-320.

Report of Major Putnam, U. S. District Engineer, November 1923.

"Amendment of Separate section 3 of Illinois Constitution (1908)

Provided further, that the General Assembly may, by suitable legislation, provide for the construction of a deep waterway or canal from the present water power plant of the Sanitary District of Chicago, at or near Lockport, in the township of Lockport, in the County of Will, to a point in the Illinois river at or near Utica, which may be practical for a general plan and scheme of deep waterway along a route which may be deemed most advantageous for such plan of deep waterway; and for the erection, equipment and maintenance of power plants, locks, bridges, dams, and appliances sufficient and suitable for the development and utilization of the water power thereof; and authorize the issue, from time to time, of bonds of this State in a total amount not to exceed twenty million dollars, which shall draw interest, payable semi-annually, at a rate not to exceed four per cent per annum, the proceeds whereof may be applied as the General Assembly may provide, in the construction of said waterway and in the erection, equipment and maintenance of said power plants, locks, bridges, dams and appliances.

All power developed from said waterway may be leased in part or in whole, as the General Assembly may be law to provide; but in the event of any lease being so executed, the rental specified therein for water power shall be subject to a re-valuation each ten years of the term created, and the income therefrom shall be paid into the treasury of the State."

Exhibit No. 15.

"A message from the Governor by James Whittaker, Secretary to the Governor:

Mr. President—I am directed by the Governor to lay before the Senate the following communication:

State of Illinois, Executive Department.
Springfield, May 10, 1907.

To the Honorable, the Senate:

In my message transmitting to the General Assembly the report of the Internal Improvement Commission of Illinois, I called attention to the importance of the matters with which the commission had to deal, and to the necessity for early legislative action in reference thereto, especially in relation to the assertion and preservation of the rights of the State in the water power to be created through the contemplated improvement of our natural water courses."

* * * * *

"In addition to this great contribution to the national waterway, the Sanitary District will as soon as it interferes with the water power of the State in Joliet at dam No. 1, pay into the State treasury $75,000 per annum, to be used in maintaining the Illinois and Michigan Canal and the navigability of the Illinois river, thus relieving the State of a pecuniary burden which it has heretofore been compelled to bear.

In my biennial message I called attention in the following language to other phases of the benefits which will result to the State from the development of a deep waterway:

In connection with this most prominent feature of the commission's work, the report of the commission shows many incidental advantages which will accrue to our own State from the construction of the proposed waterway. Among these, is the creation of 120,000 electrical horse power, which can be secured without in any way affecting

the use of the waterway as a navigable channel. At the minimum estimate of $25.00 per horse power this electrical power would afford an annual income of $3,000,000."

Respectfully submitted,

CHARLES S. DENEEN,

Governor.

Ex. 1351, Transcript 7511, 7513-14.

"(3) To use or to lease, in whole or in part, the surplus waters of such waterway or the power developed therefrom:

(4) To construct, maintain and operate power plants, structures, buildings and appliances relative thereto for the utilization of the surplus waters arising from the construction, maintenance or operation of the waterway, and to lease, sell or otherwise dispose of the whole or any part of the electrical current or energy thereby generated; * * *

Para. 21. Before any lease of surplus waters of such waterway or the power developed therefrom shall be entered into, public notice shall be given of the time and place at which proposals will be received, which notice shall be previously published for at least once a week for four weeks in two daily newspapers printed in the City of Chicago, in two of the principal engineering and contracting journals of general circulation in the United States, and in such other publications as the Department of Public Works and Buildings may deem proper. The lease, if a satisfactory bid is received, shall be awarded to the highest responsible bidder. The successful bidder shall, before entering upon the performance of such lease, enter into a bond in a penal sum to be fixed by the Department of Public Works and Buildings, payable to the people of the State of Illinois, with sureties to be approved by such Department conditioned to comply with all the terms of such lease and faithfully to fulfill any such contract. No contract or lease shall be made for a period exceeding thirty years. Any lease of undeveloped power shall provide that all plans, specifications and contracts for the con-

struction and installation of plants and equipment shall first be submitted to and approved by the Department of Public Works and Buildings and such Department shall keep an accurate account of the actual cost of such approved construction and equipment as the work progresses. Any lease for undeveloped power may be made in either of the following manners.

(1) The contract may provide that the lessee shall amortize the cost of his plant and equipment during the term of the lease and shall deliver such plant and equipment free of cost, to the State at the termination of the lease; or

(2) The contract may provide that the plant and equipment may remain the property of the lessee until the expiration of his lease, or its termination by the State. Said lease may further provide that the State may purchase such plant and equipment at cost, less depreciation at either the expiration or termination of the lease.

If the State decides under the second provision not to take over the plant and equipment at the expiration or termination of the lease, a re-advertisement for bids for use of such surplus waters shall be had in the same manner as provided for in the original letting. In the event that the lessee whose lease has expired or terminated, is not the best bidder or an equal, such lessee shall turn over, transfer and convey to the successful bidder such plant and equipment upon payment by the successful bidder to the lessee whose lease has expired or terminated, of the cost, less depreciation, of such plant and equipment.

The rental specified for surplus waters, water power or for electrical energy shall be subject to revaluation each ten years of the term created.

In determining the depreciation on plants and equipment installed by any lessee and in revaluing surplus waters, water power or electrical energy at each ten year period, the Department of Public Works and Buildings shall appoint one appraiser and the lessee one appraiser, and the two appraisers thus appointed shall agree upon a third appraiser. In the event they cannot agree upon a third ap-

praiser, the Chief Justice of the Supreme Court of Illinois shall appoint a third appraiser. The finding of such appraisers shall be binding upon the state and the lessee.

The Public Utilities Commission shall have the power to fix the rate which shall be charged by the lessee or his assigns for any electrical energy developed from such waterpower in the event of a lease for distribution of such electrical energy. The provisions of this section shall not apply to sales for a period of ten years or less when such sales are made direct to consumers or to industries of any waterpower or electrical energy developed by the State, but such sales for a period of ten years or less when made direct to consumers or industries may be made by the Department of Public Works and Buildings without advertising.

In awarding contracts for the use of undeveloped or developed power, all other things being equal, preference shall be given to municipalities."

Exhibit 1192 Para 7 (part 3 & 4)
and Para 21
Illinois Waterway Act, June 17, 1919

"17. *Illinois River, Utica to La Salle.*—The section of the river between 1 mile above Utica wagon bridge (the lower limit of the Illinois Waterway) and the junction of the Illinois and Michigan Canal with the Illinois River 0.9 mile below La Salle, 7.4 miles, has never been under improvement by the United States and the channel is obstructed by numerous bowlders. Minimum depths at low stage under present conditions are about 4 to 4½ feet. The fall in this section is about 2 feet.

18. *Illinois River, La Salle to the mouth.*—The existing Federal project adopted in 1880 provides, in connection with the State project, for a navigable channel 7 feet deep at low water of 1879 from La Salle to the mouth of the river, by the construction of four locks and dams and dredging the bars. From La Salle to Copperas Creek, the upper limit of the original United States project, the State of Illinois, has made the improvement, principally by

the construction of locks and dams at Henry and Copperas Creek, 27.2 and 86.5 miles, respectively below La Salle. From Copperas Creek to the mouth the United States has improved the river by dredging and construction of locks and dams at La Grange and Kampsville, 145.6 and 191.7 miles, respectively, below La Salle. The full width of channel has not yet been accomplished, but low water mid-channel depths in the open river are in excess of 7 feet for a width of about 75 feet. All locks mentioned are 350 feet long and 75 feet wide with 7 feet on miter sills. All dredging since 1914 has been done by the United States dredging plant, and to a depth of 7 feet below low water of 1901, the lowest stage of river since the opening of the Sanitary Canal."

Exhibit 1360 p. 9.

House Doc. 2, 67th Congress, 1st session.

"59. The link under improvement by the State of Illinois embraces all of that portion of the waterway (except the lower end of the Chicago Drainage Canal where the Sanitary District of Chicago controls a fall of 36 feet) which will afford any profitable development of water power, the fall under control of the State amounting to about 96 feet. The State expects the returns from water power alone to make its investment profitable. The extent of the water powers controlled by the State and the Sanitary District depends of course upon the amount of water which is withdrawn from Lake Michigan through the drainage canal.

60. As to whether the through waterway above described will prove of economic benefit to the Nation sufficient to justify the cost to the Federal Government of the additional improvements which it is called upon to make between Utica on the Illinois and Cairo on the Mississippi, is in my opinion a doubtful question. The State will presumably recover the value of its expenditures from water powers. The sanitary district can perhaps justify its expenditures in excavating the drainage canal by the resulting conveniences afforded for sewage disposal. The United

States will be out of pocket if a through waterway is created which does not prove to be an economical avenue of commerce."

Exhibit 1360 p. 18.

House Doc. 2, 67th Congress, 1st session.

"Q. You have referred to La Salle and Utica. You have referred to Utica as the southern terminus of the present proposed Illinois waterway, and you have referred to LaSalle as the northern terminus of the stretch of the Illinois River from its mouth up to that point.

A. I meant to use the term Utica. LaSalle had been the head of navigation for federal improvement, but the Illinois waterway stopped six miles above that at Utica, and it had been presumed that the United States would extend its portion of the improvement up to Utica."

Woermann, Transcript Vol. 16 4101-4102.

"Q. Now, are there several power sites on that section of the Des Plaines River?

A. The plan of the State was to install power plants into each of the four lower locks.

Q. And the Sanitary District has a power plant installed at the first lock, is that correct?

A. Yes, sir.

Q. Now, in order to have waterpower in connection with the waterway slack water system, it is necessary to have surplus water, is it not?

A. Well, surplus water over and above what is needed for lockage, if that is what you mean.

Q. Yes.

A. Yes, sir.

Q. This section which is under improvement by the State of Illinois includes all of the available commercial power sites between Lake Michigan and the Mississippi River, does it not?

A. Well, at Marseilles there is a power dam there, and has been for 50 years, I expect.

Q. Yes, but that is included in the State section, is it not?

A. Well I do not know exactly what you mean by that; in a general way, yes.

Q. I mean by that that it is included in the stretch of the waterway which is proposed to be improved by the State of Illinois?

A. That is right.

Q. And below the southwesterly end of the section proposed to be improved by Illinois, there are no further waterpower sites; is that correct?

A. That is right.

Q. And the improvement of the State of Illinois commences at the first available waterpower site, after you leave Lake Michigan, being the one now operated by the Sanitary District of Chicago; is that correct?

A. That is correct.

Q. Now, these waterpower sites would be quite valuable if you had a large flow of water from Lake Michigan, would they not?

A. I would think, yes.

Q. But if that flow of water were limited to the quantity needed for lockage purposes, these waterpower sites would not have any value, would they?

A. No, sir.

Q. So that the value of these waterpower sites to the State of Illinois depends upon how large a flow of water can be obtained from Lake Michigan; is that correct?

A. I think, in a general way, that is true."

Woermann, Transcript Vol. 18 pp. 4216-4218.

"Q. Will you state in a general way what these plans show which appear in Exhibit 1242 with relation to this proposed power development?

A. In a general way they show the location of the power structures, elevation of the water at each pool, the general size of the structures, and the amount of power that could be developed under different flows in the river.

Q. What amount of power in a general way, minimum and maximum, is it possible to develop by that project? I will modify that question, and ask you to state in a general way the amount of power that may be developed in connection with that project, without referring specifically to the plant.

A. Development on efficiency of 85 per cent, there may be developed at the four state dams about 72,600 horse power, with 10,000 feet of flow from Lake Michigan. In addition to this, there can be developed at the second dam from the lower end, that is, the Marseilles dam, 11,500 horse power now claimed by the private interests on the opposite side of the river. There can also be developed at the Lockport dam at least 34,800 horse power. That gives a grand total of 118,900 horse power.

Q. Now, in a general way, that development would be divided into three divisions, that at Lockport which you say is 34,800 horse power, that at the Marseilles dam of 11,000 horse power, and at intervening points of 72,600 horse power?

A. Yes, sir.

Q. The development at Lockport is the development of the Sanitary District, is it not?

A. Yes, sir.

Q. That would leave available for development by the State of Illinois or by the United States Government in conjunction with the State of Illinois, between Lockport and Marseilles, a possible power of the amount you mentioned, the 72,600 horse power?

A. Yes, sir.

Q. At what cost might that be developed, in your opinion?

A. I have estimated the cost at about seven and one-half million dollars. I believe the application to the Federal power Commission placed that at about $7,600,000. The exact figures are of record in this case.

Q. You used the estimate or the assumption of n efficiency of 85 per cent. Can that degree of efficiency be obtained, in your judgment?

A. I think so, yes, sir.

Q. Have you calculated or determined the value of that power in that locality?

A. I have estimated its value.

Q. At what?

A. My original estimate of the value of that power was $25 per horse power, including maintenance and operation of plant by lessees. The Engineer Corps previous to the time I undertook that work made the same estimate. That was before war times. Recently a contract has been let in that immediate vicinity where a large part of the power is secondary power, on the Fox River, and the rate as stated in the contract is $25 per horse power; but I believe in that instance the lessor pays for maintenance and operation. Since the date of my original estimate and the original estimate by the Engineer Corps, the cost of coal has greatly increased, the cost of labor has increased, and I believe the estimate that I originally made is very conservative, in fact, may be said to be too low.

Q. $25 per horse power per year, do you mean?

A. Yes, sir.

Q. And on the basis of the amount of power that you have calculated might be developed, what is the annual value of that possible development which you say could be created at a cost estimated at about seven and one-half million dollars?

A. The annual income from the 72,600 horsepower should be not less than $1,815,000 net to the State.

Q. What is the proper basis for determining the capital value of that property?

A. I believe the proper basis in this case is the cost to the State to obtain money for the development of this power. The State bonds are sold bearing 4% interest. In my judgment, this power can be leased so as to return to the State not less than $25 per horsepower net, and I am very confident that that figure can be exceeded; but assuming a value of $25 per horsepower per year net this should be capitalized at 4 per cent, the rate at which the State may obtain its money.

Q. And what would that amount to?

A. That would amount to $1,815,000 net income annually.

Q. The capital value is $45,375,000 gross. From this must be subtracted the cost of development, which I have estimated to be $7,500,000, leaving a net value of $37,875,000. This covers only that portion of the power to be developed by the State."

Barnes, Transcript Vol. 24, pp. 5871-5874.

"Q. Mr. Barnes, I hold in my hand a photostatic copy of a message from the Governor of Illinois received by the Senate of Illinois and dated Springfield, May 10, 1907, and appearing in the Journal of the Senate for 1907. I direct your attention to the following language:

'To the Honorable, the Senate:

'In my message transmitting to the General Assembly the report of the Internal Improvement Commission of Illinois, I called attention to the importance of the matters with which the Commission had to deal, and to the necessity for early legislative action in reference thereto, especially in relation to the assertion and preservation of the rights of the State in the water power to be created through the contemplated improvement of our natural water courses.'

Then further on:

'In my biennial message I called attention to the following language to other phases of the benefits which will result to the State from the development of a deep waterway:

'In connection with this most prominent feature of the commission's work, the report of the Commission shows many incidental advantages which will accrue to our own State from the construction of a proposed waterway. Among these, is the creation of 120,000 electrical horsepower, which can be secured without in any way affecting the use of the waterway as a navigable channel. At the minimum estimate of $25 per horse power this electrical power would afford an annual income of $3,000,000.'

Mr. Barnes, do you think the prospect of obtaining annually an income for the State, a net income of $3,000,000

by abstracting the waters of Lake Michigan had any influence upon the voters of Illinois?

A. I do, yes."

Barnes, Transcript pp. 6795-6798.

"Q. Referring to Exhibit 1194, Mr. Barnes, the first power site as you come from Chicago toward the Mississippi River is at Lockport, is it not?

A. Yes, sir.

Q. And at that point begins the easterly section of the Illinois waterway, does it not?

A. I call it the northerly; it is the upper end.

Q. The last power site as you go down from Lake Michigan to the Mississippi River is located at Starved Rock, is it not?

A. Yes.

Q. And where is the lower end of the Illinois waterway?

A. At Starved Rock, about the lower end of the lock. No definite location of the end has been made.

Q. So that the interest of the State of Illinois in a navigable waterway between Lake Michigan and the Mississippi River commenced exactly at the first power site available as you come from Chicago and terminated promptly at the last power site available, down the river towards the Mississippi? Is that correct?

A. No.

Q. Did it go farther down than that?

A. The interest of the State of Illinois extends throughout the entire valley.

Q. The part that was selected by Illinois for improvement did commence and terminate as I have indicated, did it not?

A. That was fixed by what the government had previously undertaken to develop and control. The Sanitary District at Chicago had carried the navigation improvement down to Lockport. The Federal Government had carried the improvement up to La Salle.

That left a reach of about 72-miles unimproved. The State undertook to develop that portion that had not been taken under control by the Federal Government or the Sanitary District.

In our conferences with the district engineers it was agreed that if we would carry the development to or in the vicinity of the Utica bridge, the government could very fairly extend its program up to that point.

Q. Mr. Barnes, the situation was, when you planned this Illinois waterway, that there was no one that had supervision of any improvement between the dam at Lockport and the end of the Federal project at La Salle?

A. That is right.

Q. And you undertook the improvement of not the whole of that section down to connect with the Federal project, but only so much of it as included the last power site down the river. Is that the fact?

A. Not quite. There is about a mile or a mile and a half beyond that that would carry us to the Utica bridge. The exact alignment there has not been fixed.

Q. But you did not undertake the improvement of the seven miles between the Starved Rock lock and dam and power site and the head of the Federal improvement at La Salle?

A. No.

Q. That seven miles is about correct, is it not?

A. I believe so—somewhere in the neighborhood of seven miles.

Q. Mr. Barnes, before you can have any water power at any of the power sites on this waterway from Lockport to and including Starved Rock you must have surplus water over and above that needed for slack water navigation, must you not?

A. Yes—well, that is not strictly true. You can have power in the off-navigation season or in the navigation season when there is little or no traffic.

Q. Of course, then, if you did not use it for power you would not need it for navigation in the closed navigation season?

A. No.

Q. And of course if you had little or no traffic you would not need that lockage water for navigation?

A. No.

Q. So that, strictly speaking, you would have no power unless you had water in excess of that actually used for navigation?

A. That, again, is not quite true. The natural flow of the river is very low, and the development of the natural flow of the stream has not been feasible because of its small quantity.

With the addition of even enough to provide lockage, and with the structures built for canal purposes, then it does become feasible to construct the power sites for the flow of the river exclusive of diversion from other streams.

Q. Mr. Barnes, in so far as the water from Lake Michigan is concerned, you would have none of that water available for power unless you had a surplus above that actually needed for the operation of the waterway?

A. That is right.

Q. And the more water that you can get above the amount needed for the operation of the waterway, the more power you can produce?

A. That is not quite right. When you get above a certain amount, then, the water becomes objectionable, and the cost of land damages and development becomes so excessive that we must limit the amount to a certain fixed amount.

Q. At least, up to 10,000 second feet?

A. Yes; that is quite true.

Q. What do you estimate to be the value of the power site at Lockport?

A. The power site?

Q. Yes.

A. Do you mean the land value?

Q. The value as a power site, and also what the annual income would be.

Mr. Dietz. With what flow?

Mr. Jackson. With 10,000 second feet.

The Witness. I have never been concerned with that, because we are not concerned with the development there, but, I will have to figure somewhat from memory.

By Mr. Jackson:

Q. You have estimated that before Congressional committees two or three times, have you not?

A. No, sir, I do not think so. Will you read the question?

(The pending question was read by the reporter.)

The Witness. I assume that you want the value of the power?

By Mr. Jackson:

Q. Well, you testified the other day, Mr. Barnes, that there was a certain annual net income to be derived from these power sites.

A. Yes.

Q. And capitalized that into income?

A. Yes.

Q. I do not know whether you considered that capitalized value the value of the power site—

A. (Interposing) The value of the power.

Q. Well, what is that?

A. For this location, on the value of $25.00 per horse power year, it would be a value of somewhere between 18 and 19-million dollars, net.

Q. And what would be the annual income, net?

A. About $870,000, if it could all be used for power purposes.

Q. What power output do you figure?

A. I figured that at 34,800 horse power. If a portion of that water is used for canal purposes, of course, that value must be subtracted from this amount. If, for example, the amount used for canal purposes is 1500 cubic feet per second, then the value of the surplus power would be only 85 per cent of what I have estimated.

Q. Is there any other element of value as a power site? That is, if a private corporation wished to purchase that site as an electrical site, and had a right to use that water, would there be any other element of value involved?

A. I do not recall any other value pertaining to power.

Q. Assume that there was no diversion at Lockport, or that it was limited to the actual lockage water used for navigation, what would be the value of this power site?

A. It would be nil.

Q. And the same would be true with respect to the other four power sites of the State, substantially, would it not?

A. No. They could develop some power from the natural flow of the streams.

Q. Will you state to me what is the value of the State power site at Brandon Road dam and lock, with a flow of 10,000 second feet, and what its value would be with no diversion from Lake Michigan or, with a diversion sufficient to make up what lockage water might be needed, in addition to the natural flow, if any?

A. Brandon Road is on the Des Plaines River, and the low water flow of the Des Plaines River is nil, and the mean annual flow is extremely small, so that there would be very little power at that site, other than that brought in from Lake Michigan.

Q. The fact is, if you had no water from Lake Michigan, except what was actually used for navigation, and used none of that for power, there would not be sufficient flow in the Des Plaines River at Brandon Road lock to justify the construction of a power plant, would there?

A. I think that is right.

Q. So that the value of that power site would be nil, without any diversion from Lake Michigan?

A. Well, without diversion and without any canal, it would be; but with the canal we could get some power. The fact of the matter is, there is a power plant and has been a power plant there for many years.

Q. That is, you could profitably build a power plant, if there were a canal from Lake Michigan, although you used no water from Lake Michigan for power itself, and did use what natural flow there was in the stream for navigation purposes?

A. Yes. I think we could put in a small power house that could profitably operate on the natural flow of the stream.

Q. Where would you get your surplus for that needed for navigation, if you appropriated all of the flow of the Des Plaines River and the extra water that was needed from Lake Michigan.

A. Well, if you appropriated all of the water from the Des Plaines, it would not, of course.

Q. The same situation would hold true at every other lock and dam of the State of Illinois, would it not, if you proceed on the assumption that you use the water that is there naturally for its primary purpose, that of navigation, and merely supplement it with such additional water, if any, as may be needed, from Lake Michigan to furnish the necessary lockage water?

A. No, sir. That is not true, and my answer regarding Brandon Road is not strictly true. The Brandon Road lock is only three-quarters the lift of the Starved Rock lock. Hence, it requires only three-fourths the water. The balance of that water could be used for power purposes. As we follow further downstream, the lockage lift becomes still less, and of course, the water must come down from the Lockport lock, and this surplus could be used for power development. Moreover, the streams that enter further down have a greater natural discharge, and the power becomes more valuable.

Q. Assume that you provided your lockage water in your upper lock by pumping from the lower levels, would the answer still be the same?

A. Well, that is an assumption.

Q. Well, I have made the assumption, and you will just answer on the assumption and you will just answer on the assumption, because you are not responsible for its character.

A. Of course, if you go to any such assumptions as that, I do not know what the values would be.

Q. Since we are not agreed that the difference between 10,000 second feet flow and the lockage water or zero diversion from Lake Michigan would produce a change from the values that you have given already on these power sites to one of nil, I wish you would state what would be the value of the power site at Dresden Island lock, with

no diversion from Lake Michigan, and also, if there is any difference, with diversion from Lake Michigan, for lockage water only.

A. Well, I could not do that on the stand, without an exhaustive investigation of the flow and so on, which I cannot recall, offhand.

Q. Is there any question in your mind but that, if there were no diversion from Lake Michigan, or if there were no diversion except solely for lockage water, that all of these power sites of the state would be practically valueless?

A. That would not be true. In the first place, if there is no diversion from Lake Michigan, there will be no Illinois waterway. That is an impossibility, speaking in practical terms. If the position of the complainants' case must prevail, it must be my duty—

Q. You need not discuss that. All you need to do is to answer what would be the result, on the facts assumed.

A. Well, on the fact assumed, if there is no diversion, there can be no canal. Therefore, it is an assumption we cannot make. If the diversion is limited to the use for navigation purposes, then, the power downstream from Lockport is practicable, because, for example, at Brandon Road we only require three-fourths the amount of water that we require at Lockport, and at Dresden Island, we would require less than half the amount of water we require at Lockport. The balance would be waste, unless used for power purposes.

Q. To get away from this difficulty about the waterway, will you tell me whether, assuming there was no diversion or no waterway, the power sites at Brandon Road lock, Dresden Island, Marseilles, and Starved Rock, would have any value justifying their commercial development?

A. I can answer that by stating the experience of others on that reach.

Q. I do not want you to state the experience of others. I want you to state your opinion.

Mr. Dietz. Just a minute. We think the witness should be permitted to use his experience and his knowledge.

The Special Master. He can explain on redirect what he has not an opportunity to explain on cross-examination. The question merely asks for his opinion on that assumption.

The Witness. My opinion is that there are power sites that are practical of development upon the reaches you have mentioned, without any flow from Lake Michigan.

By Mr. Jackson:

Q. Will you tell me how many horsepower you think you could develop at those points, under the assumed conditions?

A. I cannot tell you offhand, but we could develop the flow of the stream, which is quite considerable, for eight or nine months in the year.

Q. About what was the low water season, Mr. Barnes?

A. That varies, of course, from year to year. The low water season is usually in July and August.

Q. Just for two months?

A. Some years. Some years it extends into June, other years over into October. Last year, for example, we had high water in the month of August.

Q. What is the low water flow at Starved Rock?

A. The low water flow at Starved Rock is roughly 500 second feet.

Q. What is it at Brandon Road?

A. At Brandon Road the natural low water flow is nil.

Q. Now, Mr. Barnes, I show you Exhibit 1175, or a copy of it, and ask you if it is not true that all of this water that is flowing out through this power house and dam to the river over the lock is surplus water and not needed for navigation?

A. That is surplus water and not needed for navigation at that point.

Q. The same is true of the water flowing out through the power house, as shown on Exhibit 1273, is it not?

A. Yes.

"By Mr. Jackson:

Q. Now, Mr. Ramey, it has been the practice of the Sanitary District to manipulate this flow for purposes of power, has it not?

A. No, the flow has not been operated primarily for power. The flow has varied in years past.

Q. Well, did that flow vary with the quantity of power load or not?

A. No, the load would vary with the flow.

Q. Well, the power demand, if that is more accurate, Mr. Ramey: Did the flow vary with the power demand?

A. Not directly.

Q. Well, if there was any variation in flow that coincided with the power demand, is it your testimony that that was accidental?

A. No, I would not say that it was accidental. I would say this, that if the operators at the powerhouse were carrying the bulk of the load through the powerhouse and the load dropped off, like it might between the hours of 12 o'clock noon and 1 o'clock, that they might not open the dam for that one hour to let over the amount of water that was shut out of the powerhouse, due to the automatic shutting down of some of the machinery. So the record for that hour would show a low discharge from the end of the channel.

By the Special Master:

Q. Did I understand you to say that in 1926 you actually diverted less water than you were permitted to divert under this permit of the Secretary of War?

A. Yes, sir.

Q. I do not think I got your reason for that?

A. Well, I was not asked to give the reason; but there were some very bad floods in the lower Illinois River in September and the early part of October, and under instructions from Col. Schulz, we cut the flow in the canal down as low as we possibly could.

Q. That was the period of September and October you were referring to?

A. Yes, sir.

Q. Now, during the rest of the period did you divert all of the water that the permit permitted you to divert?

A. No, we diverted all that we could through the channel.

Q. Well, what was the reason—?

A. At that time, the lake was extremely low, and the Calumet River was not improved, so we could not draw through the Calumet River, much as the Sag Channel has been designed to carry.

Q. What amount are you diverting now?

A. Well, we are diverting now, I think, somewhere around 8,200 second-feet.

Q. That is, as compared with the 8,500?

A. A total of 8,200.

Q. A total?

A. Yes, sir.

Q. That is not compared, then, with the 8,500?

A. Oh, no.

Q. What are you diverting now in cubic second-feet, which would compare with the 8,500 which you are permitted to divert under the permit?

A. About 7,000.

The Special Master. You may proceed.

By Mr. Jackson:

Q. Mr. Ramey, I wish to show you complainants' Exhibit No. 145, which is entitled, Sanitary District of Chicago Main Channel, K. W. Output, and Flow at Lockport, Ill., Half Hour Averages, Typical, December Days.

Mr. Adcock. Is that an exhibit that you put in?

Mr. Jackson. It is one that was in before.

Mr. Adcock. Have you referred to it as an exhibit?

Mr. Jackson: Yes, Complainants' Exhibit 145.

By Mr. Jackson:

Q. Turning to page 9 of Complainants' Exhibit 145, that page shows that, from 4 p. m. to 5 p. m. on that day, the flow at Lockport jumped from 269,000 cubic minute feet to 589,000 cubic minute-feet, does it not?

A. It does.

Q. And it shows that the power production jumped from 9,900 kilowatts to 21,600 kilowatts, does it not?

A. It does.

Q. And that is at a time of the year, in December, when your power demand came on heaviest, between four and five o'clock, is it not?

A. That is.

Q. And that was a time when your evening power load and your day load overlapped; is that correct?

A. That is the time when the night load and day load overlapped, for half an hour.

Q. And at that time your night load was much heavier, independently of this overlapping, than your day load, was it not?

A. It was.

Q. And at 12:30, your load would ordinarily be the least, because of the shutting down somewhat of the factories of some of your largest consumers, would it not?

A. Yes, all of that commercial load goes off at noon, and leaves on the line only the load of the Sanitary District itself and the Municipal pumping station, etc.

Q. And that page 9 indicates that, on that day, the flow through the canal was speeded up very rapidly—or the flow at Lockport—between four and five p. m., and continued relatively high until the next morning at seven o'clock, does it not?

A. (Examining paper) That shows that the discharge through the powerhouse was materially increased for an hour or two, and continued heavy on through the night, because the night load then was heavier than the average capacity of the power plant.

Q. And it shows that the flow beginning in the afternoon, as the night flow came on, and continuing until, the next morning, was very much greater than it was during the daytime, does it not?

A. It shows that.

Q. And do you deny that the reasons for that great increase in flow in that time was a manipulation of the flow for the purpose of power production by the Sanitary District?

The Witness. Will the stenographer read that question?

(The Stenographer read the last preceding question.)

A. I will say that that manipulation of the flow was to get as much power out of the flow of the powerhouse as it was possible. But at this same time I know that there was a flow going over the dams. If we took all of the flow through the powerhouse, I would say that your assumption was absolutely correct, but there—

Q. Well, Mr. Ramey, you produced this exhibit 145, as typical December days for the years in question, did you not?

A. Yes, sir.

Q. And is it not true that you can turn to any of typical days in December and find that the flow was increased in that way, between four and five o'clock in the afternoon, and continued through until the next morning, until you get up to the present year?

A. (Examining paper) That is true up to 1925.

Q. Up to 1925?

A. Up to 1925.

Q. And it is likewise true that, commencing in 1925, you were tied in with the Commonwealth Edison Company of Chicago, is it not?

A. Well, we were tied in with the Edison Company as early as 1918.

Q. But only for a very short time, Ramey; is that not true?

A. Well, for the winter months—

Q. Well, are the figures you gave me at the time the complainants' case was put in, and which I had read into the record, a correct statement of the times when your plant was tied in with the Commonwealth Edison Company. That is, you furnished them. I wonder if you recall if they were correct?

A. Well, I furnished you merely a reference to the agreements—that is, I furnished you information from which you could find the actual agreements between the Sanitary District and the Edison Company.

Q. Well, we will not dispute about that state of the record. When was your company tied in with them?

A. I could not tell that without looking at the agreements myself. I know they were tied in in 1918, and I believe they were tied in again in 1919, and--

Q. Continuously?

A. No, I think those earlier agreements just provided that they should be tied in from some time in October, I think, up until around along about the spring months--I think May 1st. The agreement under which we are now working provides that we will be tied in continuously.

Q. Yes, and that is the reason why your flow and your power load is a straight line, is that not true?

A. That is why we can maintain an almost constant flow in that channel at the present time.

Q. Yes, and you could have maintained that before, as far as the flow is concerned, if you were not manipulating it for power purposes, could you not?

A. Yes, that is—

Q. There was no greater difficulty at that time in obtaining a uniform flow than exists now?

By the Special Master:

Q. I wish you would explain just what you mean by "tying in"?

A. Well, our lines are connected with the Commonwealth Edison Company at the present time. And if there is any hour in the day when the load on the Sanitary District is greater than the output of the Sanitary District hydro-electric plant, we take power from the—that is, the Sanitary District takes power from the Edison Company. And if there is any time of the day when the load on the Sanitary District plant is less than the output of the hydro-electric plant, that power automatically feeds into the Commonwealth Edison System.

Q. Yes.

A. So at the present time, our flow is absolutely steady.

Mr. Adcock. That is, it is an exchange of power.

The Special Master. Yes.

By Mr. Jackson:

Q. Mr. Ramey, your sewage load was greater in the daytime than at night, was it not?

A. I do not believe there is much difference, Mr. Jackson, between day and night on the sewage load down that channel.

Q. Did all your trade concerns operate day and night?

A. No; but sewage that might get into the upper end of the North Branch, for instance, might not get down to the middle of the main channel for fifteen or sixteen hours.

Q. Mr. Ramey, I will direct your attention to Complainants' Exhibit No. 153, being entitled, "Sanitary District of Chicago, main channel, d. w. output and flow at Lockport, half-hour averages, on days of maximum flow in each month of the year 1916." That data was prepared by you at our request, was it not?

A. Yes; that was furnished at your request.

Q. If you turn to page 7 of that sheet, being a typical day for June, the jump in the flow and power load comes at about 8:30 in the evening, does it not?

A. About 7:30.

Q. Well, it comes between 7:30 and 8:30?

A. Yes.

Q. As you look at the succeeding pages of that exhibit, being the typical days for July, August, September, October, November and December, is it not true that the time when this doubling of the flow starts goes forward in the afternoon; that is, from 8 to 7:30 and 7:30 to 7 in each month as the days get shorter?

A. Yes; that flow is increased as the street lighting load of the city of Chicago comes on the system.

Q. Then, that was done for the purpose of generating power, that manipulation of flow?

A. Well, that particular change was.

Q. That particular change or manipulation has been constant up to the last two years, has it not?

A. Yes, that flow has varied, but in that year I think we used only 85 per cent of the total flow through the power house.

Q. It has been constantly varied, has it not, for power purposes?

A. Well it has been operated to carry the load that was put on the plant.

Q. Well, you have an electrical engineer in charge of the Lockport power house, have you not?

A. Yes, sir.

Q. And he regulates the flow down there for the purposes of operating the plant as a power house? Is that true?

A. He used to do it.

Q. Well, he did that up to 1925? Is that correct?

A. Yes."

Ramey, Transcript 4342-4354.

"Q. Now, Mr. Ramey, referring to this manipulation of flow in connection with the power load, you stated that was a process of drawing off the storage water in the canal, did you not?

Mr. Adcock. I do not know whether that was called 'manipulation,' or whether that is a Wisconsin term.

The Special Master. I think it has become an Illinois term as well, because both of you used it in your examination, as I noticed at the time. 'Manipulation' can be used without any offensive innuendo, and I suppose both sides have used it. Certainly Illinois has used it.

A. Well, the drawing off of the surplus water in the early evening hours is taking that water from storage at the lower end of the channel.

By Mr. Jackson:

Q. And you said it took three or four hours to draw that storage water off, did you not?

A. No, I do not think I stated any definite time. It would depend on how much stored water there was and the rate at which you drew it off.

Q. Now, this running of a large quantity of water, according to these exhibits, began in the evening as the light load came on and continued fairly well until the load went off the next morning?

A. It did in years past.

Q. I am referring to the period prior to this last year that you pointed out when it had a straight load. Does not that affect the current of the Chicago River?

A. That heavy flow continues as long as the city street-lighting load in Chicago is on the line.

The Special Master. The point is, did it affect the current of the Chicago River?

The Witness. I do not think it did.

The Special Master. That is an answer.

By Mr. Jackson:

Q. That is assuming that the exhibits showed that extra flow to continue in December from 4:30 or 5 in the evening until 7 the next morning, it is your opinion that it did not affect the current of the Chicago River?

A. I stated that it would take sixteen hours or more, possibly up to twenty-four hours, to change from one flow to another. Now the greatest period of time that that heavy load is on the plant is 14 hours in the winter time. So the flow in the Chicago River would be changed slightly, but it would not be altogether changed. That is, if you had a light flow of, say, 5,000 second feet in the Chicago River in the afternoon, in the late afternoon, when you increased that flow that discharge at Lockport up to, say, 10,000 I doubt if at the end of fourteen hours you would have increased the flow in the Chicago River up to 10,000. In fact, I know you would not have raised it that much.

Q. In order that I may understand it, the situation is that when you assume double the flow at 4:30 in the afternoon, and continue it substantially on that basis until the next morning, it would not have doubled the flow in the Chicago River by the next morning, but it would have made a very substantial increase in the flow of the Chicago River by the next morning, would it not?

A. It would have made a substantial increase in the upper end of the main channel, and that increase would continue for some hours after you had shut off the heavy discharge at Lockport.

Q. Because they would be filling in that storage that had been drawn off at the lower end of the canal?

A. Yes, sir.

Q. So that as I understand you, the maximum change in current which you would have obtained in the Chicago River would appear by 7 the next morning when you cut off the heavy night load. Is that correct?

A. Well, the change in the Chicago River would appear some 16 hours after the change appeared at Lockport.

Q. By that you mean that the greatest effect would be felt in 16 hours?

A. No.

Q. Or that the effect would not be felt for 16 hours?

A. No effect at all would be observed for four hours.

Q. In the Chicago River?

A. Then you would observe a slight change, that change gradually increasing until at the end of 24 hours you would probably have 80 per cent of the change.

Q. What would you have at the end of 14 hours?

A. I do not know. You would have some change.

Q. It would be a substantial change, would it not, Mr. Ramey?

A. Not at the upper end of the Chicago River, around the lake part.

Q. Would it not increase the flow in the Chicago River by over 50 per cent in 14 hours? Fifty per cent of an increase, I mean, Mr. Ramey.

A. Yes, it might do that.

Q. And, as I understand your testimony, then that increase would continue for several hours after you had raised the controlling works at Lockport in order to fill up that storage?

A. Yes, it would. That is the flow in the Chicago River always lags hours behind the discharge from the channel at Lockport.

Q. That is what I have been trying to get at.

A. And the further away you get from Lockport, the greater that lag.

Q. And that maximum effect which you said probably would exceed 50 per cent would be felt in the morning when the controlling gates were raised. Is that correct?

A. Yes, it probably would.

Q. And then continue for three or four hours from that time?

A. Yes, sir.

Q. And did that not cause considerable trouble to navigating the Chicago River?

A. I do not think so.

Q. It would increase the current some considerable per cent, would it not?

A. I do not think it would. I do not think the way that canal has been operated that the current in the Chicago River would have been increased in excess of the figure stated in the permit of 1901, that is, a mile and a quarter an hour.

Q. Regardless of the relation to the permit, I want to know if it would not substantially increase the current.

Mr. Adcock. From what point?

A. From what to what?

By Mr. Jackson:

Q. From the current then existing before you started that extra flow.

A. Well, the change in the discharge at Lockport was being made from time to time, and those changes would not reflect back in the Chicago River for hours.

Q. We have been all over that. As I understand it, we have now gotten the fact of 50 per cent of the matter back in the Chicago River by the next morning, to continue for several hours. We have reached that point. Now I want to know if that does not materially increase the current in the river over what obtained before you started this extra flow.

A. If we had—

The Special Master. Just answer the question. It is perfectly clear. Go ahead and answer it.

The Witness. I do not understand the question, Judge.

The Special Master. Read the question, and then the witness may answer it, and let us end this branch of the discussion by taking the witness' answer.

(The last preceding question was read by the reporter.)

The Witness. In other words, you want me to answer that Yes or No.

The Special Master. Yes. I want you to give an intelligent answer. It is a perfectly clear question.

The Witness. Here is a point where you are running a heavy flow for fourteen hours, and a somewhat lighter flow for ten hours, and in that ten hours you would not have established that extremely slow current.

The Special Master. Do you not know whether in the conditions described the current would or would not be increased?

A. By increasing the discharge at Lockport it would increase the flow in the Chicago River some hours later, and by decreasing the flow at Lockport it would decrease the flow in the Chicago River, some hours later.

The Special Master. Now you are asked on a certain assumption, based on your testimony, with regard to the increased flow fourteen hours later, that is, after the change, whether that would affect the current in the Chicago River. What is your answer?

A. It would affect it.

By Mr. Jackson:

Q. Does the storage water in the southwest end of the Drainage Canal have any effect on the rapidity with which you take water off in case of storm?

A. Yes, sir.

Q. It tends to prevent the rapid drawing off of storm water, does it not?

A. No. The more water you have stored in there, the more you can draw off.

Q. That is, the more water you have stored above the dam at Lockport, it is your testimony that the more quickly you can draw water off through the channel?

A. Yes; because you have a greater head there, a greater depth of flow over the dam, and a greater head through the sluice gates.

Q. As I understand you, when you store water you raise the gates in order to back up and accumulate water at that end of the Drainage Canal?

A. Yes, sir.

Q. And it is your testimony that the more you raise the gates and the more you back up the water and accumulate it in the end of the Drainage Canal, the more easily you can draw off storm water from the Chicago River.

A. No, not at all.

Mr. Adcock. The other question did not relate to the Chicago River. It related to the end of the Drainage Canal.

A. You asked me if I could not take more water out at the lower end of the main channel, with more water stored there and a higher head, and I answered that.

By Mr. Jackson:

Q. What I want to know, Mr. Ramey, is when you have accumulated storage water in the way which you have described, does not that hinder the drawing off of storm waters from the Chicago area?

A. Yes. It is better to have the canal lower at Lockport."

Ramey, Transcript 4480-4489.

"Mr. Wisner. You operated an electric power plant while you were Chief Engineer of the Sanitary District?

A. Yes, sir. I built it.

Q. And you sold a part of the electric power? Is that true?

A. Practically sold it all, except what we used ourselves.

Q. And you made a substantial profit on that, did you not?

A. Well, we made a profit in the beginning on the commercial load. We made no profit on the municipal load; in fact, I think we lost money on it.

Q. What profit did you make on the commercial load?

A. I do not recall.

Q. Mr. Wisner, in 1924 you testified before the Rivers and Harbors Committee, did you not?

A. I did, yes, sir.

Q. Referring to page 1623 of Part 2 of the hearings of 1924 before the Rivers and Harbors Committee, I find this testimony by you:

'Mr. Wisner: That is, with the regulating works in use, generally the value of power at Chicago is about three times what it is around Niagara Falls.

'Mr. Hull: Do you mean they would pay three times as much for it?

'Mr. Wisner: No.

'Mr. Hull: You want to explain that?

'Mr. Wisner: I mean the net value of it is about three times as much.

'Mr. Hull: Why is that?

'Mr. Wisner: Because it costs so much to make it at Niagara Falls and costs so much to make it in Chicago. In Chicago it costs $26.40 per horse-power to make the power and we were selling it for $55 per horse power, where we sold it commercially, I mean. That means a profit of about $29.'

Do you think that was substantially correct?

A. I think that was. That was on the commercial load. We did make a profit on that.

Q. The rest of it you used yourself?

A. No; as distinguished between the Sanitary District and the other municipalities most of it was sold to the city of Chicago and the park systems and pumping stations and public buildings at that price, as I recall it, of $26.40 for horse-power which had been regarded as cost."

Wisner, Transcript 3755-3757.

SANITARY DISTRICT OF CHICAGO
TABULATION OF FLOWS THROUGH LOCKPORT POWER HOUSE, AND OUTPUT OF SAME.

Year	Flow Through Power House C. F. S.	Lockport Power House Output KWH[2]
1908	1640	21,000,000
1909	3399	50,534,040
1908-09	2520	35,767,020
1910	4262	72,861,101
1911	5287	83,663,000
1912	5580	88,908,800
1913	6195	98,208,590
1914	6672	106,764,600
1910-14	5599	90,077,618
1915	7047	109,631,300
1916	7387	112,326,700
1917	7454	119,374,900
1918	7511	120,201,000
1919	8030	126,375,200
1915-19	7486	117,581,820
1920	7910	120,581,400
1921	7657	117,875,300
1922	8178	122,551,800
1923	8031	124,135,700
1924	8938	126,572,600
1920-24	8142	122,343,360
1925	8032	117,747,200
1926	8245	118,196,700

[2]Kilowatt-Hours.

Exhibit 1112, Tr. 3374-3375.

"THE SANITARY DISTRICT OF CHICAGO

ENGINEERING DEPARTMENT

Page 22

Subject THE SANITARY DISTRICT OF CHICAGO
Computation Main Channel-K. W. & Flow at Lockport, Ill. No Friday

Computed by .....

	Total flow K. W.	Date Dec. 14, 1923 C. F. M.
12 Midnight	15600	497500
	15500	495500
1	15200	488500
:30	14500	472000
2	14000	429000
:30	14200	434000
3	13900	426000
:30	14100	421000
4	14100	421000
:30	14100	421000
5	14200	423500
:30	14200	423500
	12800	392500
6	9500	
:30	8500	278000
	8900	
7	10100	288500
:30	11200	
8	12800	359000
:30	13300	393500
9	13300	393500
:30	13100	389500
10	13100	389500
:30	13000	387500
11	13000	387500
:30	13200	391500
	12600	379000
	11700	334000

12 Noon	6700	
:30	6800	210500
	11700	
1	12100	331000
:30	12100	335000
2	12100	335000
:30	12000	330000
3	12000	330000
:30	11300	319000
4	10300	299000
30	10300	294000
	14800	
5	18300	483500
	21500	
:30	20900	623000
6	20200	607000
:30	19700	611000
7	19600	609000
:30	19000	594500
8	18600	602000
:30	17800	582500
9	17100	565500
:30	16400	549000
10	15800	517000
:30	15800	517000
11	15800	517000
:30	15700	514560

Exhibit 145, p. 22.

"DIVERSION FOR SANITARY PURPOSES, CHICAGO DRAINAGE CANAL

The flow in the lower end of the canal always varies considerably during the day, being generally small during the daytime and large at night. The flow is regulated mostly by the draft of water at the power house, which carries a heavy lighting load at night. The Saturday and Sunday loads do not differ greatly from the loads of the other week days.

During the 12 hours or more that the heavy night load is on the storage in the canal is being drawn down while the water surface profile along the canal gradually approaches its new position of equilibrium. This equilibrium requires much more than 12 hours for establishment, and it therefore happens that the flow into the upper end of the canal has not become as great as the flow out of the lower end at daybreak when the lighting load is thrown off. During the daytime conditions are reversed, and the inflow is greater than the outflow, the storage being built up slowly."

Exhibit 211 9248-9249.

Warren Report.

"It is manifest that so long as the City is permitted to increase the amount of water which it may take from the Lakes, there will be a very strong temptation placed upon it to postpone a more scientific and possibly a more expensive method of disposing of its sewage. This is particularly true in view of the fact that by so doing it may still further diminish its expenses by utilizing the water diverted from the Lakes for water power at Lockport. But it must be remembered that for every unit of horsepower realized by this water at Lockport four units of similar horsepower would be produced at Niagara, where the natural conditions are so much more favorable."

Exhibit 12, Doc. 41, p. 404.

Opinion of Secretary of War Stimson, 1913.

APPENDIX "R."

The Illinois and Michigan Canal shall never be sold or leased until the specific proposition for the sale or lease thereof shall first have been submitted to a vote of the people of the state, at a general election, and have been approved by a majority of all the votes polled at such election. The general assembly shall never loan the credit of the state, or make appropriations from the treasury thereof, in aid of railroads or canals: Provided, that any surplus earnings of any canal may be appropriated for its enlargement or extension (Separate Sections, 3, Illinois Constitution of 1870, page 59, the Statutes of Illinois by Gross; Vol. 2; 1872)

Ex. 5, Tr. 209.

Complainants' Exhibit No. 6, resolution of Illinois General Assembly.

"Whereas, the state of Illinois, in general assembly, did on the sixteenth day of February, 1865, grant and authorize the city of Chicago, in the state of Illinois, to deepen the Illinois and Michigan canal for the purpose of, and with the intent to better the system of sewage of the said city of Chicago by permitting a free flow of water from Lake Michigan through the Chicago river and said canal to the Des Plaines and Illinois rivers; and the city of Chicago did perfect said improvement in conformity with said permission; and

"Whereas, the great fire in the said city of Chicago on the eighth and ninth days of October, A. D. 1871, did so greatly damage the assessable property of a very large number of its citizens and taxpayers, and the People of the State of Illinois did, by its general assembly, refund to the said city of Chicago the amount of the cost of deepening the Illinois and Michigan canal, said sum refunded being in gross two millions nine hundred and fifty-five thousand three hundred and forty dollars; and

"Whereas, the deepening of the canal as aforesaid has proved to be totally inadequate for the purposes in-

tended, and the large amount of sewage of the city of Chicago being far greater than the capacity of the canal and the water now passing through it to deodorize and render innocuous; and

"Whereas, the foulness of the water annually causes the death of millions of fish in the Des Plaines and Illinois rivers that float to the shores and decay; and

"Whereas, said sewage, in an entirely undecomposed and putrid mass, is carried by the current of the canal into the Des Plaines river, and thence into the Illinois river, and in its foulest condition is thus transported to and below the city of Peoria, in said state, rendering the air, at all points along its passage, so impure and foul as to be exceedingly offensive, and taking with it germs of disease of all kinds prevalent in the city of Chicago, and thus spreading them broadcast through the entire Des Plaines and Illinois river valleys, causing thereby much illness as well as poisoning of the blood, and devilitating the systems of 200,000 people; and

"Whereas, careful investigation leads our people to fear that an epidemic may spread over said section of the state of Illinois from the causes above stated; and

"Whereas, in addition to the above distress, there has been a great loss to property, business industries, and to the communities in said region, by reason of the causes herein mentioned; and

"Whereas, prior to the deepening of said Illinois and Michigan canal, the water necessary for all purposes of navigating said canal and propelling of machinery was obtained from the Des Plaines river and the Calumet feeder, through Lane's Lake; and

"Whereas, the bed of the Des Plaines river, at the summit and thence westward along the line of and adjacent to the canal, is at a low stage of water, eight (8) feet below the surface level of the canal, and will average a supply of water sufficient for all canal and power purposes during the seasons of navigation; and

"Whereas, the supplying of the canal from these sources will so dilute and weaken the sewage of the city of Chicago, to greatly relieve it of its foulness and stench, to the great delight, relief and health of the people near to and bordering upon the line of the canal, the Des Plaines and Illinois rivers; therefore, be it

"Resolved by the Senate, the House of Representatives concurring therein, That the Board of Canal Commissioners of the Illinois and Michigan canal be, and they are hereby, directed to cause sluiceways of sufficient capacity, with the proper guard-gates, to be opened from the Des Plaines river to the canal, at or near the Summit, in Cook County, and at or near Lemont, in Cook County, and also to construct a dam across the former Calumet feeder at such suitable point as will cause the waters from Lane's Lake to flow into the canal; that said canal commissioners shall immediately commence, construct and improve said sluices and feeders in the order named, and pay for the same out of any moneys in their hands or control as canal commissioners, resulting from the earnings of the canal. The amount to be expended as above designated in the prosecution of said improvement shall not, however, exceed the sum of ten thousand dollars; Provided, that the canal commissioners shall first confer with the mayor or other proper authorities of the city of Chicago, and if said city shall proceed without delay to cause a flow into the canal from the Chicago river sufficient to dilute and purify the waters, and thus remedy the evils complained of, said flow to be not less than 60,000 cubic feet per minute, including the ordinary flow into the canal from the Chicago river, or so much thereof as in their judgment said canal can carry, and if this shall be accomplished by the first day of September, 1881, the commissioners shall accept it in lieu of obtaining a supply of water from the other sources named; Provided, further, that said commissioners are hereby directed to take care of the 60,000 cubic feet per minute, above contemplated, if so furnished by the city of Chicago; Provided, further, that the adoption of this resolution shall not commit the state to a system

of permanent drainage of Chicago sewage through either the canal or Des Plaines or Illinois rivers, but that the state reserves the right to require the city of Chicago, in future years, to take care of its sewage through other channels.

Ex. 6. Pages 210-214.

Resolution of Illinois General Assembly, 1881.

Complainants' Exhibit No. 3-C.

Mr. Jackson. We now offer to read into the record Complainants' Exhibit No. 3-C, being an extract from the Warren Report, page 173.

"In 1881 the protest of the people of Joliet and other parts of the Des Plaines and Illinois Valleys had become so loud that the State passed a resolution requiring Chicago to provide a flow of 1,000 cubic feet per second or abandon the use of the canal for sewage dilution. In compliance with these resolutions the city built a new pumping station of the required capacity at Bridgeport, together with a lock to prevent back flow from the canal into the river. Pumping commenced in 1883. For a few years this afforded sufficient dilution in the canal and there were no more complaints from the valley. Unfortunately, when the pumping plant was installed Lake Michigan stood at a very high stage and the pumps were given only sufficient capacity to provide the legal 1,000 cubic feet per second under these conditions. In 1886 the lake level began to fall, and continued to do so until in 1891 it was about 2 feet lower than when the pumps were installed. Their capacity thereby being reduced to a little more than 600 cubic feet per second. As the growth of the city had continued at its usual rate, the nuisance along the canal became at times as bad as ever."

Ex. 3-C. Tr. 213.

Warren Report.

Complainants' Exhibit No. 7.

Mr. Jackson. We now offer Complainants' Exhibit No. 7, being a joint resolution of the general assembly of Illinois, entitled "Chicago Sewerage System—Committee to Investigate," appearing in the laws of Illinois of 1887 at page 314:

"Whereas, the city of Chicago contemplates to transfer the vast sewage of the city and the waters of Chicago River into the Des Plaines and the Illinois rivers.

"Whereas, the people of the State living along the river, are alarmed that the waters which in some places are used for domestic purposes, are still more polluted.

"Whereas, the Illinois River at LaSalle will be wholly inadequate to carry off this additional volume of water and cause disastrous overflows; therefore,

"Resolved by the Senate, the House concurring therein, That a committee of ten, four from the Senate and six from the House, be hereby appointed by the respective presiding officers, to inquire into all the above questions, and report to the General Assembly as early as possible.

Ex. 7. Tr. 217-218.

"CHICAGO DRAINAGE SYSTEM—COMMITTEE TO EXAMINE IN VACATION.

Resolved By The House of Representatives, The Senate Concurring Herein. That a commission of five (5), consisting of the Mayor of Chicago, *ex-officio*, two members of the House, selected from different political parties, to be appointed by the Speaker, and two members of the Senate, selected from different political parties, to be appointed by the President of the Senate, shall examine and report to the next session of the Illinois Legislature the subject of the drainage of Chicago and its suburbs. If such commission shall find, upon investigation, that the most practicable solution of the problem is in the construction of a waterway for the sewage from Chicago to the Des Plaines River at or near Joliet, the commission shall

report what requirements should be made as to the construction of such water-way and the dilution of such sewage for the protection of the health and comfort of the people along the Des Plaines River at and below Joliet. Said commission shall serve without pay, and the expenses of the same may be paid by the City of Chicago.

And the Speaker appointed as such joint committee on the part of the House, Messrs. MacMillan and Riley, and the President of the Senate appointed, on the part of the Senate, Messrs. Eckhart and Bell."

Exhibit 8, Transcript 218-219.

Resolution, Illinois Assembly, 1887.

Complainants' Exhibit No. 10.

Mr. Jackson. The next offer is Complainants' Exhibit No. 10, being an act of the Illinois Legislature, approved May 29, 1889, appearing in the laws of Illinois of 1889 on pages 126 to 137, inclusive, and entitled "An Act to create sanitary districts, and to remove obstructions in the Des Plaines and Illinois rivers." From that we read beginning with section 20:

* * * * *

"Section 22. Nothing in this act contained shall be so construed as to constitute a contract or grant between the State of Illinois and any sanitary district formed under its provisions, or to prevent, debar or deprive the State of Illinois from, at any time in the future, altering, amending or repealing this act, or imposing any conditions, restrictions, or requirements other, different or additional to any herein contained upon any sanitary district which may be formed hereunder.

"Section 23. If any channel is constructed under the provisions hereof by means of which any of the waters of Lake Michigan shall be caused to pass into the Des Plaines or Illinois rivers such channel shall be constructed of sufficient size and capacity to produce and maintain at all times a continuous flow of not less than 300,000 cubic feet

of water per minute, and to be of a depth of not less than fourteen feet, and a current not exceeding three miles per hour, and if any portion of any such channel shall be cut through a territory with a rocky stratum where such rocky stratum is above a grade sufficient to produce a depth of water from Lake Michigan of not less than eighteen feet, such portion of said channel shall have double the flowing capacity above provided for, and a width of not less than one hundred and sixty feet at the bottom capable of producing a depth of not less than eighteen feet of water. If the population of the district drained into such channel shall at any time exceed 1,500,000, such channel shall be made and kept of such size and in such condition that it will produce and maintain at all times a continuous flow of not less than 20,000 cubic feet of water per minute for each 100,000 of the population of such district, at a current of not more than three miles per hour, and if at any time the general government shall improve the Des Plaines or Illinois rivers, so that the same shall be capable of receiving a flow of 600,000 cubic feet of water per minute, or more, from said channel, and shall provide for the payment of all damages which any extra flow above 300,000 cubic feet of water per minute from such channel may cause the private property so as to save harmless the said district from all liability therefrom, then such sanitary district shall within one year thereafter, enlarge the entire channel leading into said Des Plaines and Illinois rivers from said district to a sufficient size and capacity to produce and maintain a continuous flow throughout the same of not less than 600,000 cubic feet of water per minute with a current of not more than three miles per hour, and such channel shall be constructed upon such grade as to be capable of producing a depth of water not less than eighteen feet throughout said channel, and shall have a width of not less than one hundred and sixty feet at the bottom.

Ex. No. 10. Tr. 220, 221-224.

Act of Illinois Legislature of May 29, 1889.

"Bernard A. Eckhart, President
Melville E. Stone, Treasurer
Charles S. Denneen, Attorney
James Reddick, Clerk
Isham Randolph, Chief Engineer

THE SANITARY DISTRICT OF CHICAGO
Rialto Building,

Sanitary District
of Chicago
State of Illinois

Board of Trustees:
William Boldenveck,
Joseph C. Branden
Zina R. Carter
Bernard A. Eckhart
Alexander J. Jones
Thomas Kelly
James P. Mallette
Thomas A. Smyth
Frank Wenter

Chicago, June 16, 1896.

To the Honorable Daniel S. Lamont,
Secretary of War,
Washington, S. D.

Dear Sir:

"The work of the Sanitary District of Chicago has progressed so far that it is now necessary for us to enter upon that which must be done in the Chicago River to make available the artificial channel which we have under construction from Robey Street, Chicago to Lockport in Will County, twenty-eight miles distant.

"Our connection with Lake Michigan must be through the Chicago River with the West Fork of the South Branch of which we make a junction at Robey Street. We send herewith a map showing in a general way our plans for improving the Chicago River by widening and deepening at the points indicated thereon by red hatchings and by figures which refer to explanations given in the legend on the map. It is desired to so correct and regularize the cross section of the river as to secure a flowage ca-

pacity of 300,000 cubic feet per minute with a velocity of one and one quarter miles per hour. The cross-section necessary to accomplish this can be obtained throughout the greater part of the distance between Monroe Street and Robey Street by dredging the river to a depth of 20 feet at mid-stream with 12 feet at dock lines, and a uniform slope away from docks of one foot in five so that the full depth would be reached forty feet from the dock lines; but there are places so narrow that this cross-section can only be obtained by widening the river; and again the depth to be obtained in the vicinity of Van Buren Street is limited by the height of the crown of the Tunnel. To obviate this difficulty it is proposed to secure the requisite cross-section by constructing a by-pass to the West of the bridge at Adams, Jackson, and Van Buren Streets as indicated. We ask your permission to proceed with the work upon the lines indicated and so far as is consistent with propriety the co-operation of the United States Engineer Department.

"Awaiting your favorable reply and holding ourselves ready to respond to any call from you for fuller information as to our plans, I am

"Yours respectfully,

"B. A. ECKHART,

President."

Doc. No. 1, Ex. 12, Tr. 228-230.

Subject: Application of Trustees Sanitary District, Chicago.

UNITED STATES ENGINEER OFFICE,
1637 Indiana Avenue, P. O. Drawer 132.
Chicago and Calumet Harbors,
Illinois and Calumet Rivers
Illinois and Mississippi Canal

Major W. L. Marshall,
Corps of Engineers, U. S. A. Chicago, Ill.,
June 24, 1896.

Brig. Gen. Wm. P. Craighill,
Chief of Engineers, U. S. A.
Washington, D. C.

General:

"I have the honor to report upon the application of Mr. B. A. Eckhart, President Board of Trustees Sanitary District of Chicago, for the authority of the Secretary of War to make certain changes in the capacity of the channel of Chicago River for drainage purposes.

"As far as the work itself is concerned there can be no objection to it, as in every case the navigable channel of Chicago River will be improved, and at this stage I am unable to do otherwise than to recommend the granting of the authority sought.

"The question that must come up later for the action of the War Department, to-wit. Whether the improved channel of Chicago River will be sufficient to carry 300,000 cubic feet of water per minute without lessening or destroying the navigability of Chicago River, or whether the City of Chicago will be allowed by the United States and Great Britain to take any water at all from the Great Lakes, with the inevitable result of lowering their levels, is not now under investigation, and is one that will not probably be settled or decided by executive officers. It is, or may rather be considered an international question.

"For the present, I have to respectfully recommend that the necessary authority be granted as requested for the *general* plan, under the following conditions:—

"(1) That while the general plan is approved, the Sanitary District of Chicago, must furnish plans in triplicate on an enlarged scale showing each proposed new bridge, each by-pass, and each new dock or wharf, proposed to be built, in order that the Secretary of War, under the law may act intelligently in each case.

"(2) That this authority shall not be interpreted as approval of the plans of the Sanitary District of Chicago to introduce a current into Chicago River. This latter proposition must be hereafter submitted for consideration.

"(3) That it will not cover obstructions to navigation, by reason of this work while in progress, or when completed.

"(4) That the United States shall not be put to expense by reason of this work.

"(5) That this authority will expire by limitation in two years from date, unless extended.

"Very respectfully,

"Your obedient servant,

"(Signed) W. L. MARSHALL,

"*Major, Corps of Engineers.*"

Doc. No. 2. Ex. 12, Tr. 230-232.

Recommendation of U. S. District Engineer.

"Improvement of Chicago River.
4554 July 3, 1896.

Sir:

"I have the honor to acknowledge the receipt of your letter of 16th ultimo, requesting permission to make certain changes in the capacity of the channel of the Chicago River, for draining purposes, at points indicated on the map accompanying the application, and in reply beg to say that upon investigation it is found that the permission requested can be granted upon the following conditions:

"1. That while the general plan is approved, the Sanitary District of Chicago, must furnish plans in triplicate on an enlarged scale showing each proposed new bridge, each by-pass, and each new dock or wharf, proposed to be built, in order that the Secretary of War may act intelligently in each case.

"2. That this authority shall not be interpreted as approval of the plans of the Sanitary District of Chicago to introduce a current into Chicago River. This latter proposition must be hereafter submitted for consideration.

"3. That it will not cover obstructions to navigation, by reason of this work, or when completed.

"4. That the United States shall not be put to expense by reason of this work.

"5. That this authority will expire by limitation in two years from date unless extended.

"Very respectfully,

"JOSEPH B. DOE,

"*Acting Secretary of War.*

B. A. Eckhart, Esq.,
President, The Sanitary District of Chicago,
Rialto Building, Chicago, Illinois."

Doc. No. 4, Ex. 12, Tr. 236-237.

Permit July 3, 1896.

"Permit of November 16, 1897.

"Whereas, by Section 3 of the Act of Congress, approved July 13, 1892, entitled 'An Act making appropriations for the construction, repair and preservation of certain public works on the rivers and harbors and for other purposes,' it is provided that, without the permission of the Secretary of War, it shall not be lawful to build any wharf, pier, dolphin, boom, dam, weir, breakwater, bulkhead, jetty or structure of any kind outside established harbor lines or where no harbor lines are or may be estab-

lished in any port, homestead, haven, harbor, navigable river, or other waters of the United States, in such manner as shall obstruct or impair navigation, commerce or anchorage of said waters; or to excavate or fill, or in any manner to alter or modify the course, location, condition or capacity of any port, roadstead, haven, harbor or refuge, or inclosure within the limits of any breakwater of the channel of any navigable water of the United States, unless approved and authorized by the Secretary of War;

"And whereas, the Sanitary District of Chicago has submitted to the Secretary of War for his approval the attached plans for the widening of the Chicago River between Quincy and Harrison Streets of said city, by the construction of by-passes and docks;

"Now, therefore, this is to certify that the Secretary of War hereby approves and authorizes the works shown on said plans upon the following conditions:

"1. That while the general plan is approved, the Sanitary District of Chicago must furnish plans in triplicate on an enlarged scale showing each proposed new bridge, each by-pass, and each new dock or wharf, proposed to be built, in order that the Secretary of War may act intelligently in each case.

"2. That this authority shall not be interpreted as approval of the plans of the Sanitary District of Chicago to introduce a current into Chicago River. This latter proposition must be hereafter submitted for consideration.

"3. That it will not cover obstructions to navigation, by reason of this work while in progress, or when completed.

"4. That the United States shall not be put to expense by reason of this work.

"5. That this authority shall expire by limitation in two years from date unless extended.

"Witness my hand this 16th day of November, 1897.

"R. A. Alger,

Secretary of War."

Document No. 5, Ex. 12, Tr. 237-239.

"UNITED STATES ENGINEERS OFFICE
No. 1637 Indiana Ave., Chicago, Ills.
April 24th, 1899.

Brig. Gen. John M. Wilson,
Chief of Engineers, U. S. A.,
Washington, D. C.

General:

"I have the honor to report as follows on the application of the Trustees of the Sanitary District of Chicago for authority to open their Drainage Canal. It is a strange fact that this city has expended, or will expend, over $30,000,000 with the intention of diverting an apparently unlimited amount of water from the Great Lakes to the Mississippi drainage area for sanitary purposes without finding out whether such diversion would be allowed by the great interests of the United States and the Colonies of Great Britain along the chain of Great Lakes in the navigation of the rivers and harbors of the Great Lakes. Now they ask the authority of an executive officer of the United States to open a channel that will to some unknown extent lower the levels of all the Great Lakes below Lake Superior and of their outlets, introduce a current also unknown and not to be ascertained otherwise than by actual experiment, in Chicago River, the most important navigable river of its length on the Globe, but which is already obstructed by bridges, masses of masonry and bends, and of difficult navigation at best.

The possible effects of this diversion are not known, further than that to some unknown degree they will be injurious. Whether the amount of this injury will be so small as to be accepted by the interests affected in view of the manifest advantages to and apparent necessities of their neighbors, cannot be determined by other than the interests themselves.

It is clear to me that I am not competent to make a recommendation as to what should ultimately and definitely be done.

The matter of what effect the opening of this channel would have on the levels of the Great Lakes has been here-

tofore submitted to a Board of Engineers. That Board reported that the Great Lakes would be lowered, but that there was not sufficient data to determine the exact effects of the proposed discharge, and recommended extended investigations, which it is believed are being carried on now by the Deep Waterways Commission, or Board. They have not reported. In my opinion the abstraction of from 300,000 to 600,000 cubic feet per minute will permanently lower Michigan, Huron and Erie from 3 to 8 inches; not more than 8 nor less than 3 inches, corresponding to an extreme reduction of from 160 to 466 tons in carrying capacity of the large vessels of the Lakes, and that it will take from three to four years for this full effect to be attained. But the State law is unlimited in its requirements. 20,000 cubic feet per minute must be taken from Lake Michigan for each 100,000 population of the district; already nearly 400,000 c. ft. must be taken, and at the same ratio of increase for a few decades, in a very short time there must be taken 1,000,000 c. ft. per minute under this indefinite law. The amount should be limited and the injurious effect stopped somewhere.

The mean current to be introduced in Chicago River upon the opening of the canal is estimated by the engineers of the Drainage Board at one and one-fourth miles per hour or 110 ft. per minute. This is simply an assumption that with such velocity in an unobstructed river, the amount of 300,000 cubic feet per minute can be discharged through Chicago River—but I have seen this River so jammed with vessels, drawing all the water that is in it, that by leaping from deck to deck I could cross the river. What the velocity would be in such conditions with Lake Michigan on one side and a great fall on the other side of such vessels, no one knows. But it is a simple mathematical problem to determine the effect on steel-plate vessels of from 2,000 to 4,000 tons mass drifting upon or striking stone piers with a velocity of near two feet a second. They will go to the bottom.

Individually I have to say that I am in entire sympathy with this people in their effort to purify their water supply. I have lost my only son from typhoid fever, pro-

duced I believe from drinking water polluted by defective drainage at Chicago, which this channel will correct. In every proper way I have aided the officers of the Drainage district. I would like further to aid them, but I believe this question to be entirely out of my sphere, and too great and important for me even to venture an opinion or make a recommendation about. I yet may venture to suggest that the entire subject to be referred to Congress for final solution, and that a conditional permit or authority be granted to the authorities of the Chicago Sanitary District by the War Department, awaiting action by Congress, to open their channel, and under the following conditions:

"1st: That if, at any time, it becomes apparent that the current created by such drainage works in the South and Main Branches of Chicago River, be unreasonably obstructive to navigation or injurious to property, the Secretary of War reserves the right to close said discharge through said channel or to modify it to such extent as may be demanded by navigation and property interests along said Chicago River and its South Branch.

"2nd: That the Sanitary District of Chicago must assume all responsibility for damages to property and navigation interests by reason of the introduction of a current in Chicago River.

"With 300,000 cubic feet per minute discharge it will take one year to lower the level of Lake Michigan and Huron one-tenth of a foot, and several years to reach the maximum permanent effect of this discharge, which will not probably much exceed three inches, so that the main injury to navigation, if any, that can be expected before action by Congress, will be in Chicago River, and that can be at once abated.

"All the changes made by the Sanitary District of Chicago, taken by themselves, have been such as to increase the navigable capacity of Chicago River. Taken in connection with the current to be introduced I am not able to say that the river will be as navigable as it was before these changes were made. The changes materially lessen the probable injury to navigation of this current, at the points where the changes have been or will be made.

"I believe their channel will be entirely under control and that if the discharge be injurious it can be at once and at any time shut off, and it is evident that the War Department should reserve the right to control the current and discharge through the controlling works at this channel.

"Very Respectfully,

"Your obedient servant,

"W. L. MARSHALL,

"*Major, Corps of Engineers, U. S. A.*

Doc. 7, Ex. 12, Tr. 243-248.

Report of U. S. District Engineer upon Application of Sanitary District to open Chicago Drainage Canal.

4th Indorsement.

OFFICE CHIEF OF ENGINEERS
U. S. ARMY

"Respectfully returned to the Secretary of War.

"The Trustees of the Sanitary District of Chicago desire the permission of the Secretary of War to open their drainage canal as set forth in the within instrument.

"The application has been considered by Major W. L. Marshall, Corps of Engineers, to whose report of the 24th instant attention is respectfully invited.

"Major Marshall expresses the opinion that the final solution of this matter should be remitted to Congress, but that pending action by Congress a conditional permit might be granted subject to the following conditions:

"1. That if, at any time, it becomes apparent that the current created by such drainage works in the South and Main branches of Chicago River, be unreasonably obstructive to navigation or injurious to property, the Secretary of War reserves the right to close said discharge through said channel or to modify it to such extent as may be de-

manded by navigation and property interests along said Chicago River and its South Branch.

"2. That the Sanitary District of Chicago must assume all responsibility for damage to property and navigation interests by reason of the introduction of a current in Chicago River.

"I concur in this opinion.

"A protest against granting this application has been filed by the Mayor of the City of St. Louis, a telegram from whom is herewith.

"JOHN M. WILSON,
"Brig. Gen., Chief of Engineers,
U. S. Army.

28918/7

Doc. 8, Ex. 12, Tr. 249-251.

Recommendation of Chief of Engineers upon foregoing Application.

PERMIT OF MAY 8, 1899

"Whereas, by section 10 of an act of Congress, approved March 3, 1899, entitled 'An act making appropriations for the construction, repair, and preservation of certain public works on the rivers and harbors, and for other purposes, "it is provided that it shall not be lawful to alter or modify the course, location, condition, or capacity of the channel of any navigable water of the United States unless the work has been recommended by the Chief of Engineers and authorized by the Secretary of War prior to beginning the same' "; and

"Whereas the Sanitary District of Chicago, a municipal corporation organized under the laws of the State of Illinois, has constructed an artificial channel from Robey Street, Chicago, to Lockport, and has heretofore been granted permission by the Secretary of War to make cer-

tain improvements in the Chicago River for the purpose of correcting and regulating the cross section of the river so as to secure a flowage capacity of 300,000 cubic feet per minute, with a velocity of 1¼ miles an hour, it being intended to connect the said artificial channel with the West Fork of the South Branch of Chicago River at Robey Street in the city of Chicago; and

"Whereas the said Sanitary District of Chicago has now applied to the Secretary of War for permission to divert the waters of the said Chicago River and cause them to flow into the said artificial channel at Robey Street, as aforesaid; and

"Whereas the said Sanitary District of Chicago represents that such movable dams and sluice gates as are necessary to at all times secure absolute and complete control of the volume and velocity of flow through the Chicago River have been constructed:

"Now, therefore, the Chief of Engineers having consented thereto, this is to certify that the Secretary of War hereby gives permission to the said Sanitary District of Chicago to open the channel constructed and cause the waters of Chicago River to flow into the same, subject to the following conditions:

"1. That it be distinctly understood that it is the intention of the Secretary of War to submit the questions connected with the work of the Sanitary District of Chicago to Congress for consideration and final action, and that this permit shall be subject to such action as may be taken by Congress.

"2. That if, at any time, it becomes apparent that the current created by such drainage works in the South and main branches of Chicago River be unreasonably obstructive to the navigation or injurious to property, the Secretary of War reserves the right to close said discharge through said channel or to modify it to such extent as may be demanded by navigation and property interests along said Chicago River and its South Branch.

"3. That the Sanitary District of Chicago must assume all responsibility for damage to property and nav-

igation interests by reason of the introduction of a current in Chicago River.

"Witness my hand this 8th day of May, 1899.

"R. A. ALGER,
Secretary of War.

JOHN M. WILSON,
Brigadier General, Chief of Engineers,
United States Army.

Doc. 9, Ex. No. 12, Tr. 251-253.

Permit of May 8, 1899.

Chicago, Illinois, March 14, 1901.

Hon. Elihu Root,
Secretary of War,
Washington, D. C.

Sir:

"By reason of the rapid current in the Chicago River since the waters of Lake Michigan were turned into the Main Drainage Channel, navigation of that stream has been attended with great difficulties and serious damage to all interests. The records in your Department show that the maximum discharge of water has at times exceeded 350,000 cubic feet per minute, causing a velocity of nearly three miles per hour.

"The business interests along the River, which include coal, lumber, grain and manufacturies, represented by the Chicago River Improvement Association; and the owners of vessels upon the Great Lakes, are strongly of opinion that safe and speedy navigation of the River demands that the flow of water should be reduced to a discharge of not to exceed 200,000 cubic feet per minute, thereby producing a current not to exceed one and one-quarter miles per hour, and to remain at such flow until improvements are made in the River from time to time permitting a great discharge.

"The Chicago River Improvement Association therefore respectfully requests that the necessary and proper order be given to the Board of Trustees of the Sanitary District requiring them to reduce immediately the flow of water through the Chicago River to a maximum of 200,000 cubic feet per minute.

"The facts which will be presented to you by Mr. Frank J. Firth, representing the Lake Carriers Association, showing the difficulties under which vessels were moved through the Chicago River last season and the damages which resulted from the excessive current, are all well known to this Association and are fully endorsed by it.

"Yours respectfully,

"GEO. J. BRINE,
"*President.*
"Chicago River Improv. Assn."

Doc. 10, Ex. 12, Tr. 255, 56, 57.
Protest of Chicago River Improvement Association.

UNITED STATES ENGINEER OFFICE,
1637 Indiana Avenue, O. D. Drawer 132.
Chicago, Ill., March 29, 1901.

Brig. Gen. John M. Wilson,
Chief of Engineers, U. S. Army,
Washington, D. C.

General:

In compliance with your indorsements of March 20 and later dates, I have the honor to submit report upon the requests of the Chicago River Improvement Association and others that the Secretary of War issue an order requiring the Board of Trustees of the Sanitary District of Chicago to reduce the flow of water through the Chicago River to 200,000 cubic feet per minute, and to construct additional controlling works at the junction of the South Branch of the River with the Sanitary Canal.

* * * * *

"The situation therefore is this: A great work has been projected and put in operation for the benefit of the public health of the City of Chicago without endangering the health of the people in the valleys below, and it is the duty of the Sanitary Trustees to obey the State laws with respect to flow and dilution, if possible. They have no discretionary power to modify the provisions of the State laws, but 'shall thereafter maintain the flow of such quantity of water,' which at this time should exceed 300,000 cubic feet per minute. On the other hand the river interests maintain that so great a flow is dangerous to navigation in the Chicago River and its South Branch by reason of obstructive bridges and tunnels, and lack of width and depth, and while they do not wish the flow to be shut off they request it to be reduced, and seem to have agreed upon 200,000 cubic feet per minute through the Chicago River as a maximum. The Sanitary Trustees themselves recognize the dangers to navigation from increased discharge under the present conditions, for a special commission has been created to formulate plans for the enlargement of the Chicago River, and preliminary estimates for several projects have been prepared involving very large expenditures, and probably additional legislation. But even if the Sanitary Trustees had unlimited funds and authority to begin construction at once, some years must elapse before the channel of the Chicago River would be in a condition to take the ultimate flow of 600,000 cubic feet per minute at a moderate current, and in the meantime the Sanitary Trustees must maintain the proportional flow required by State Laws unless restrained by superior authority.

* * * * *

"There should be a provision, however, for increasing the flow in the sanitary canal during the winter when navigation is suspended, or in time of flood to prevent overflow at the spillway reversing the current and carrying sewage down the Chicago River into the Lake.

"With regard to additional controlling works, I am of the opinion that the Secretary of War is not concerned with them, his duties being limited to the interests of navigation of the Chicago River.

"The plan I have suggested seems to me calculated to protect all interests, making navigation reasonably safe in the Chicago River, insuring the greatest dilution of sewage possible under present conditions in Chicago River, protecting the Sanitary Trustees in the discharge of their duties, and placing the War Department in a just and friendly attitude towards all.

"Early action is desirable as navigation will open within a few days.

"Very Respectfully,

"Your obedient servant,

"J. W. WILLARD,

Major, Corps of Engineers."

Doc. 11. Ex. 12, Tr. 257-263.

Report of U. S. District Engineer.

"4th indorsement

OFFICE, CHIEF OF ENGINEERS
U. S. ARMY.

April 4, 1901.

"Respectfully returned to the Secretary of War.

"By an instrument dated May 8, 1899, the Secretary of War granted the Sanitary District of Chicago permission to divert the waters of Chicago River and cause them to flow into the artificial channel, constructed by the said corporation, known as the 'Drainage Canal.'

"Previously, permission had been given the said corporation to make certain improvements in the river, for the purpose of correcting and regulating the cross section of the river with a view to securing a flowage capacity of 300,000 cubic feet per minute with a velocity of one and one-quarter miles an hour.

"One of the conditions upon which the permit of May 8, 1899, was granted reads as follows:

"'That if, at any time, it become apparent that the current created by such drainage works in the South and Main Branches of Chicago River, be unreasonably obstructive to navigation or injurious to property, the Secretary of War reserves the right to close said discharge through said channel or to modify it to such extent as may be demanded by navigation and property interests along said Chicago River and its South Branch.'

"It is alleged by the various commercial and navigation interests that the present discharge from the river into the drainage channel, sometimes exceeding 300,000 cubic feet per minute, causes a velocity of nearly three miles per hour which greatly endangers navigation in the present condition of the river, obstructed as it is by numerous bridges and tunnels and being of limited width and depth. These interests all unite in asking that the discharge be reduced to not exceeding 200,000 cubic feet per minute with a view to reducing the current to not to exceed one and one-quarter miles an hour.

"Inviting attention to the accompanying report of the 29th ultimo from Major Willard, I recommend that in pursuance of the condition above quoted, the Secretary of War issue an order to the Sanitary District of Chicago requiring that the discharge from the river into the drainage canal be so regulated that the maximum flow through the Chicago River and its South Branch shall not exceed 200,000 cubic feet per minute.

"I further recommend that Major Willard be instructed to observe and gauge the river at suitable points, where the greatest and most dangerous velocities may be expected and if he finds that the resulting currents are such as to permit an increase of the maximum flow beyond 200,000 cubic feet per minute without endangering navigation or property, he so report to the Secretary of War with a view to a consideration of the question of a modification of his order.

"JOHN M. WILSON,

"Brig. Gen., Chief of Engineers,
U. S. Army.

Ex. 12. Tr. 264-267.

Recommendation of Chief of Engineers.

"PERMIT OF APRIL 9, 1901.

"Whereas, under date of May 8, 1899, the Secretary of War granted permission unto the Sanitary District of Chicago to open the artificial channel from Robey Street, Chicago, to Lockport, and cause the waters of Chicago River to flow into the same, upon the following conditions, *inter alia.*

"2. That if, at any time it become apparent that the current created by such drainage works in the South and main branches of Chicago River be unreasonably obstructive to navigation or injurious to property, the Secretary of War reserves the right to close said discharge through said channel or to modify it to such extent as may be demanded by navigation and property interests along said Chicago River and its South Branch;

"And whereas it is alleged by various commercial and navigation interests that the present discharge from the river into the drainage canal sometimes exceeds 300,000 cubic feet per minute, causing a velocity of nearly 3 miles per hour, which greatly endangers navigation in the present condition of the river;

"Now, therefore, this is to certify that the Secretary of War, upon the recommendation of the Chief of Engineers, hereby directs said sanitary district to regulate the discharge from the river into the drainage canal so that the maximum flow through the Chicago River and its South Branch shall not exceed 200,000 cubic feet per minute.

"Witness my hand this 9th day of April, 1901.

ELIHU ROOT,

"(Seal) *Secretary of War.*"

Doc. 12. Ex. 12. Tr. 267, 268.

Permit of April 9, 1901.

"THE SANITARY DISTRICT OF CHICAGO.
"Security Building
"Chicago, July 15, 1901.

To the Honorable Elihu B. Root,
Secretary of War,
"Washington, D. C.

Sir:

"I have the honor to request on behalf of the Sanitary District of Chicago that your order of April 9th, 1901, restricting the flow of water through the Chicago River to 200,000 cubic feet of water per minute, may be so amended as to permit the Controlling Works at Lockport, the outlet of the Main Drainage Channel, to be so regulated as to permit at that point a flow of 300,000 cubic feet of water per minute, between the hours of four P. M. and twelve o'clock midnight.

"The Board of Trustees of the Sanitary District have rigidly observed the restrictions of your order of April 9, 1901, but the result has been that the water in the Main Drainage Channel has become greatly polluted and very offensive both to sight and smell and is working such hardship upon the valley communities as to evoke frequent protest from various cities and municipalities along the Des Plaines and Illinois Valleys.

"By such a modification of your restricting order as is herein petitioned, it would be possible for the Sanitary District to secure much better drainage of the City of Chicago and the purification of the waters of the Chicago River without any hardship or inconvenience whatever to the interests of navigation as the opening of the Controlling Works to a flow of 300,000 cubic feet of water per minute would produce no appreciable effect upon the current of the Chicago River until three hours thereafter and would not produce the full effect until about eight hours after the opening of the gates. Therefore, by again diminishing the flow at midnight to the requirements of your order, or to 200,000 cubic feet of water per minute, the normal condition in the Chicago River would be restored

before six A. M. on the following day and thus no hardship or inconvenience occasioned to the navigation interests of the Chicago River.

I have the honor to be,

"Very respectfully yours,

ALEX J. JONES,
President.

Ex. 12, Doc. 13, Tr. 268-270.

"UNITED STATES ENGINEER OFFICE
1627 Indiana Ave., P. O. Drawer 132
Chicago, Ills., July 16, 1901.

"Brig. Gen. G. L. Gillespie,
Chief of Engineers, U. S. Army,
Washington, D. C.

General:

"I have the honor to enclose a copy of a letter to the Honorable Secretary of War from the President of the Board of Trustees of the Sanitary District of Chicago, requesting permission to increase the flow of the canal to 300,000 cubic feet per minute between 4 P. M. and midnight daily.

"It was the intention to ask me to forward the original but through inadvertence it was mailed direct and President Jones named me to forward the enclosure as original, it being duly signed.

"I believe that the increase should be allowed for the preservation of health not only in the Sanitary District but in the River Valley below, the object being to flush the canal and waterway. Boats do not navigate the Chicago river at night, except in the lower part of the main stream, generally east of the Rush Street Bridge. The maximum effect would not be felt until midnight and reduced to present day flow by about 6 A. M.

"A portion of the flow through Chicago River is due to pumping by the State about 40,000 cubic feet per minute

into the Illinois and Michigan Canal, and the Controlling Works of the Sanitary Canal are set to draw about 160,000 cubic feet per minute. Wind and lake oscillations make it impracticable to maintain a constant flow of 200,000 cubic feet per minute through the Chicago River, but I am of the opinion that there has been no lack of effort to comply with the permit of April 9, 1901.

"If the 8-hour increase is allowed, the Trustees will publish the fact for the benefit of navigation.

The river is being dredged to 26 feet depth in the narrowest parts, bridges are being reconstructed as rapidly as possible, and condemnation proceedings begun to widen the South Branch to 200 feet.

I recommend that the request of the Board of Sanitary Trustees be granted, subject to revocation by the Secretary of War in case the increase be found dangerous to navigation.

Very respectfully,

Your obedient servant,

J. H. WILLARD,

Major, Corps of Engineers.

1 enclosure

Doc. 14. Ex. 12, Tr. 270-272.

Recommendation of U. S. District Engineer.

OFFICE CHIEF OF ENGINEERS,
UNITED STATES ARMY.

July 22, 1901.

Respectfully returned to the Secretary of War.

By an instrument dated April 9, 1901, the Secretary of War directed the Sanitary District of Chicago to regulate the discharge from the Chicago River into the Drainage Canal so that the maximum flow through the Chicago River and its South Branch shall not exceed 200,000 feet per minute.

The Sanitary District now asks that this order be so amended as to permit an increase of the flow into the Canal to 300,000 cubic feet per minute between 4 P. M. and 12 midnight daily.

It is the opinion of Major Willard, expressed in the accompanying letter of the 16th instant that the request should be granted, subject to revocation by the Secretary of War in case the increase be found dangerous to navigation.

"I concur in this opinion and recommend that the order of April 9, 1901, be modified accordingly.

G. L. GILLESPIE,
Brigadier General, Chief of Engineers, United States Army.

(Third indorsement)

War Department,
July 25, 1901.

Approved as recommended by the Chief of Engineers.

E. ROOT,
Secretary of War."

Doc. 15, Ex. 12, Tr. 274, 275.

THE SANITARY DISTRICT OF CHICAGO
Security Building,
Chicago, October 16, 1901.

"Hon. Elihu Root,
Secretary of War of the United States,
Washington, D. C.

Dear Sir:

The undersigned respectfully petition you as Secretary of War to give us permission for an increased flow in the Chicago River, over the 200,000 cubic feet a minute, now in force by your order of July 23, 1901. We, the petitioners, inasmuch as a number of very material improve-

ments have been made in the Chicago River, such as removing center pier bridges, widening the river at many points, and also deepening the same, thereby allowing a much greater flow without any perceptible increase in velocity of the current, believe that we are fully justified in petitioning you to grant to the Board of Trustees of the Sanitary District of Chicago permission to increase the flow from 200,000 to 250,000 cubic feet per minute, during that period of the day allowing a flow of 200,000 cubic feet per minute.

Below we enumerate the following improvements:

The old Randolph Street center pier bridge is now removed and all obstructions which hindered navigation will be out of the way but a few weeks, and a bascule type, with a 140 foot opening, will be erected, similar to that on Taylor St.

The old Harrison Street center pier bridge is removed, and a new bascule type bridge, with 140 foot opening, with by-passes on each side, is being erected instead.

At Taylor Street the new bascule bridge is in operation, which has a clear opening of 120 feet.

The new bascule bridge of the Chicago Terminal Transfer Railway Company is about ready to be operated, and the old center pier will immediately be removed.

Just north of 12th street the river has been widened, by the cutting away of the 12 foot corner, which projected into the river at this place.

From 12th Street to Stewart Avenue, the river has been deepened below the hydraulic grade line to a depth of twenty-six feet. Also a strip from 400 feet above 18th Street to Stewart Avenue was made 200 feet wide.

At Canal Street, the old jack-knife bridge with projecting piers has been removed, and a new bridge of the bascule type—the same as at State, Randolph and Harrison Streets—is in process of erection.

The River from Canal Street to 22nd Street has been widened in the east side about 30 feet.

The deepening of the river to 26 feet, from 22nd street to about 500 feet of Main Street, is almost completed.

Along this stretch the river has been widened for a distance of about 300 feet at Collision Bend.

From 150 feet east of Halsted Street to 150 feet west of Halsted Street, the river was deepened to 28 feet.

From 900 feet east of Main Street to 300 feet west of Main Street, the river has been widened to 200 feet.

The old center pier bridge and pier at Main Street have been removed, and a new bridge of the same type as at Taylor Street is being erected.

The old center pier bridge and center pier at Ashland Avenue have been removed, and a new bridge of the Page bascule type, with a clear opening of approximately 140 feet with a 40 foot by-pass on each side of the river, is in process of erection.

The removal of the State Street center pier bridge has been contracted for, and a bridge of bascule type with 140 foot clear opening, and by-passes on each side is to be erected immediately.

In view of the foregoing improvements that are being carried out now, and many others which will follow as quickly as said work can be performed, we feel justified in asking you to permit the Sanitary District of Chicago to increase the flow as hereinbefore suggested.

The Sanitary District of Chicago has ample funds to pay for all of these improvements as fast as they are carried out, and many others that are being matured, as the Legislature during last Spring empowered the District to issue $5,000,000.00 additional bonds, besides, the tax levy will be somewhat larger than in the past.

While we believe that the improvements that have been made on the Chicago River, and the additional improvements that will be completed in the very near future, warrant us fully to ask for your permission for a full flow of 300,000 cubic feet per minute, but inasmuch as we desire to give the greatest consideration to the navigation interests on the Chicago River, we will ask only for 250,000 cubic feet per minute until the close of navigation.

Trusting that you will immediately grant us said permission, we are,

Respectfully,

Wm. H. Baker,
Jos. C. Braden,
Zina R. Carter,
Frank X. Cloidt,
Wm. Legner,
Thomas J. Webb,
Frank Wentner,

Board of Trustees of the Sanitary District, of Chicago.

Doc. 16, Ex. 12, Tr. 275-278.

Application of the Sanitary District of Chicago.

CORPS OF ENGINEERS, UNITED STATES ARMY.

Office of Division Engineer
Northwest Division

1637 Indiana Avenue,
Chicago, Illinois.
November 5, 1901.

Brig. Gen. G. L. Gillespie,
Chief of Engineers, U. S. Army,
Washington, D. C.

General:

In compliance with the instructions contained in your indorsement of the 23rd ultimo, I have the honor to submit the following report upon the application dated October 16, 1901, from the Board of Trustees of the Sanitary District of Chicago to the Hon. Secretary of War for authority to increase the flow in the Chicago River.

On the 8th of May, 1899, the Secretary of War granted permission to the Sanitary District of Chicago to turn the waters of the Chicago,—and through that of Lake Michigan,—into the Drainage Canal. The amount of

water to be passed through the river into the canal was not specified in cubic feet, but it was provided that if at any time the current in the river should be unreasonably obstructive to navigation, or injurious to property, the Secretary of War reserved the right to stop the flow or modify it to such extent as might be demanded by navigation and property interests along the river. Under this permit the drainage canal was operated during the season of 1899 and 1900, the quantity of water passed through the river being about 300,000 cubic feet or more per minute. The inconvenience and danger to navigation caused by the passage of this volume of water was so great that, in response to loud and repeated complaints of the navigation interest, the Secretary of War, on the 9th of April, 1901, directed the Sanitary District of Chicago to regulate the discharge so that the maximum flow through the river should not exceed 200,000 cubic feet per minute.

The State law, under which the Trustees of the Sanitary District are acting, required that the channel should have a capacity of 300,000 cubic feet per minute, with a current not exceeding 3 miles per hour, and if the population who contributed sewage 3 miles per hour, and if the population who contributed sewage thereto shall at any time exceed 1,500,000 the channel should be made and kept of such size that it would maintain a flow of not less than 20,000 cubic feet per minute for each 100,000 of the population, at a current not exceeding 3 miles per hour. That degree of dilution was deemed necessary to make the discharge of Chicago sewage into the Illinois River harmless to the people dependent upon that river. The law evidently intended to require not only that the channel should be large enough, but that the flow mentioned should be maintained. In the execution of their trust under the law, the Board of Trustees cannot rest satisfied with a flow of less than 300,000 cubic feet per minute whether that amount be really necessary for the proper sanitation of the Illinois River or not.

In response to an appeal from the Board the Secretary of War, on the 23rd of July, last, modified his order of the 9th of April, last, so as to permit a flow of 300,000 cubic

feet per minute from 4 P. M. to midnight, the flow during the remaining 16 hours of the day to remain at 200,000 cubic feet per minute.

The Board now ask that they be permitted to discharge 250,000 cubic feet per minute instead of the 200,000 now authorized between midnight and 4 P. M. They say nothing about the hours from 4 P. M. to midnight, and it may be assumed that they would expect to continue the discharge of 300,000 cubic feet now authorized for those hours. They give as a ground for this request the improvements which they have made in the Chicago River, which, they claim, will permit a much greater flow without any perceptible increase of velocity, and they present a list of obstructive bridge piers removed and of places where the river has been widened or deepened by excavation.

The enlargement of the Chicago River has been begun by the Sanitary District under a systematic plan and able management. It has made good progress as shown by the list of improvements; but it is very far from complete. Eight bridges are mentioned, of which one has but just been put out at contract; there are 20 more bridges to be removed. There are three tunnels under the river, which are among the worst obstructions of all; no steps for their removal have been taken. A large amount of widening has to be done. The project contemplates an expenditure of about $9,024,000 and does not include the removal of the tunnels. Of this sum about $1,000,000 has been expended. Some work was done before the adoption of the present project. Roughly speaking then, the improvement is about one-ninth completed. Relief has been given to navigation at detached points, but the ground taken that the improvements have been extensive enough to accommodate a much greater flow without detriment to navigation is untenable. If a flow of 250,000 cubic feet per minute would have been a serious injury to navigation last year, it would be so still. Persons representing the navigation interest are decidedly of opinion that it would have been so then and would be so now. Unfortunately this is only an opinion and must remain so until it can be tested by experiment.

The Board of Trustees say nothing about the sanitary question, which is the essential question after all. If it can be shown that the discharge of sewage with the present degree of dilution into the Illinois River is endangering the lives of the people on its banks, either the discharge must be stopped entirely or the dilution must be increased sufficiently to make it harmless. I can see no middle ground.

It is, in my judgment, quite too late to discuss the question of shutting off the flow entirely and turning the sewage of Chicago back into the lake. The grave necessity which impelled the people to undertake a work upon which they have expended over $35,000,000 has increased rather than diminished with the advance of time. In the face of that necessity a temporary, or even a permanent, injury to the navigation interest becomes a secondary importance. If, as I believe, the Drainage Canal must be accepted as an accomplished fact, the question is narrowed down to the one,—how much flow is required to make it harmless to the people below?

The Board of Trustees in their letter throw no new light upon the subject, but I am reliably informed that the immediate cause of their application is the result of the investigations which have been recently in progress as to the quality of the water below the Drainage Canal. It is found that with the present flow the quality is not satisfactory. Whether so large an increase as that asked for is necessary at this time does not appear, and until it does appear, need not be granted. A discharge of 250,000 cubic feet per minute throughout the 24 hours will give 24,000,000 cubic feet more in a day than the discharge now authorized, or an average increase of 16,666-2/3 cubic feet per minute. It is desirable that the flow be made as uniform as practicable to facilitate observations as to its effect upon the currents in the river. That question is complicated not only by varying stages and slopes of the water, but also by the changes of cross section caused by the more or less crowded condition of the shipping. It is, of course, possible to so enlarge the Chicago River that any reasonable amount of water can be passed through it without unduly obstructing navigation. A very important

enlargement has been begun and further enlargements can be made in the future if needed. These works are costly and slow, and the use of the canal cannot await their completion. In the meantime, if injury be inflicted upon the navigation interest, the Sanitary District should be liable to that interest for damage.

It is accordingly recommended that in lieu of the 200,000 cubic feet per minute from midnight to 4 P. M. and the 300,000 cubic feet per minute from 4 P. M., to midnight now authorized, the Board of Trustees of the Sanitary District of Chicago be authorized to regulate the discharge so that the maximum flow through the Chicago River shall not exceed 250,000 cubic feet per minute throughout the 24 hours of the day, it being understood that the Board is to be responsible for all damages inflicted upon the navigation interest; the question of further increase to remain open, awaiting evidence of its necessity.

Very respectfully,

Your obedient servant,

O. H. ERNST,

Lieut. Col. Corps of Engineers, U. S. A.,
Division Engineer, Northwest Division.

Ex. 12, Doc. 17, Tr. 279-285.

Recommendation of U. S. Division Engineer.

4th Indorsement

OFFICE CHIEF OF ENGINEERS

U. S. ARMY.

November 9, 1901.

Respectfully returned to the Secretary of War.

By direction of the Secretary of War the Sanitary District of Chicago is required to regulate the discharge of water into the Chicago Drainage Canal so that the maximum flow through the Chicago River shall not exceed 200,000 cubic feet per minute from midnight to 4 P. M., nor 300,000 cubic feet per minute from 4 P. M. to midnight.

Application is now made by the Board of Trustees for permission to increase the flow between midnight and 4 p. m., daily, to 250,000 cubic feet per minute.

In the accompanying report of the 5th instant, the local engineer officer Lieut. Col. O. H. Ernst, Corps of Engineers, recommends that, in lieu of the present authorized rates of flow as stated above, authority be granted the applicant to regulate the discharge so that the maximum flow through the Chicago River shall not exceed 250,000 cubic feet per minute throughout the 24 hours of the day, the Board to be responsible for all damages resulting thereby to navigation interests.

I concur in this recommendation, it being understood that this permission will be subject to modification should the change authorized above prove dangerous to navigation.

Previous papers herewith.

G. S. GILLESPIE,
Brig. Gen. Chief of Engineers,
U. S. Army.

Ex. 12, Doc. 18, Tr. 286-289.

Recommendation of Chief of Engineers.

PERMIT OF DECEMBER 5, 1901.

"Whereas, under date of May 8, 1899, the Secretary of War granted permission unto the Sanitary District of Chicago to open the artificial channel from Robey Street, Chicago, to Lockport, and cause the waters of Chicago River to flow into the same, upon the following condition, *inter alia:*

" '2. That if at any time it becomes apparent that the current created by such drainage work in the South and main branches of Chicago River be unreasonably obstructive to navigation or injurious to property, the Secretary of War reserves the right to close said discharge through said channel or to modify it to such extent as may be de-

manded by navigation and property interests along said Chicago River and its South Branch.'

"And whereas the Secretary of War subsequently directed said Sanitary District of Chicago to regulate the discharge of water into the Chicago drainage canal so that the maximum flow through the Chicago River shall not exceed 200,000 cubic feet per minute from midnight to 4 P. M. nor 300,000 cu. ft. per minute from 4 P. M. to midnight; and

"Whereas said Sanitary District of Chicago has applied to the Secretary of War for permission to increase the flow between midnight and 4 p. m. daily to 250,000 cubic feet per minute, and Chief of Engineers has recommended that the increase applied for be granted, but that the rate of flow from 4 p. m. to midnight be reduced to 250,000 cubic feet per minute, so that the flow through the Chicago River shall not exceed 250,000 cubic feet per minute throughout the 24 hours of the day;

"Now, therefore, this is to certify that, in accordance with the recommendation of the Chief of Engineers, the Secretary of War hereby gives unto said Sanitary District of Chicago permission to regulate said discharge so that the maximum flow through the Chicago River shall not exceed 250,000 cubic feet per minute throughout the 24 hours of the day, upon the following conditions:

"1. That this permission shall be in lieu of the present authorized rates of flow as stated above.

"2. That the permission herein given shall be subject to such modification as in the opinion of the Secretary of War the public interests may from time to time require.

"3. That said Sanitary District of Chicago shall be responsible for all the damage inflicted upon navigation interests by reason of the increase in flow herein authorized.

"Witness my hand this 5th day of December, 1901.

"WM. CARY SANGER,

"Assistant Secretary of War."

Doc. 19. Ex. 12. Tr. 290, 291.

Permit of December 5, 1901.

Complainants' Exhibit No. 13.

Mr. Jackson. The next offer for the record at this point is Complainants' exhibit No. 13, now reading as follows:

"In 1902 Col. O. H. Ernst, United States Engineer at Chicago, made a report to the Chief of Engineers, Report of Chief Engineers, 1902, App. K. K., p. 2097.

'Since the flow of the Chicago River has been reversed through the South Branch by the discharge into the sanitary canal the slope has also been reversed from the lake upstream and the depth correspondingly reduced. This loss in navigable depth will be more than restored in the main stream and in the South Branch by the excavations of the sanitary district, which, in order to facilitate the flow of the large volume of water required for the dilution of the sewage discharged into the drainage canal, has undertaken to enlarge those portions of the Chicago River to a width of 200 feet and central depth of 26 feet. These dimensions have no relation to the draft of vessels using the river, and if maintained as they should be for drainage purposes will furnish a navigable depth in excess of the requirements. The south fork of the South Branch and the North Fork, however, do not share in these benefits. In the South Fork particularly the dimensions of channel obtained by the operations of the Government were seriously impaired by the change of slope. The sanitary district has undertaken to restore these dimensions, and will no doubt do so, though it has been prevented from fully accomplishing the work by some difficult rock excavation. But it has not undertaken as yet to maintain them.

"The Chicago River is the main sewer of Chicago and as such is subject to deteriorating influences as a navigable channel from which there is no escape. The city ordinances against dumping solid matter into it are ample, and, I think, generally well observed. But a very large amount of solid matter must of necessity go into it with a perfectly legitimate use of it as a sewer. Periodical dredging will be necessary to maintain it as a navigable channel and, eventually, to maintain it even as a sewer. That work

would seem to be as much the duty of the city as the maintenance of any other part of its sewer system. So far as the South Branch is concerned, the question has been solved by the necessities of the drainage canal, as already mentioned, but the sanitary district has not accepted responsibility for maintaining the other branches. Whether that organization or some other representing the people of Chicago should do the work is for them to decide, but it seems to me clear that the United States should not be called upon to do it. Accordingly, no estimate for maintaining the channel excavated under the project of 1896 is submitted.' "

Doc. Ex. 13, Tr. 292, 293.

"War Department

January 17, 1902.

"Approved in pursuance of provisions of Section 10 of River and Harbors Act of March 3, 1899, subject to the following conditions:

"1. That this act shall not be construed as involving the General Government in any way with the expense incident to the carrying out of the project; nor as in any way invalidating, waiving or affecting the right of the Secretary of War to regulate or revoke the permit granted under date of May 8, 1899, to the Sanitary District of Chicago, to divert the waters of the Chicago River and cause them to flow into the artificial channel known as the 'Chicago Drainage Canal'; nor as authorizing in any way any invasion or impairment of the legal rights of any person or corporation.

ELIHU ROOT,

Secretary of War."

Ex. 12 Doc. 20. Tr. 295, 296.

Permit of January 17, 1902.

"Thomas A. Smith, President
Frank X. Cloidt, Vice President
James Todd, Attorney
Isham Randolph, Chief Engineer
Fred M. Blount, Treasurer
A. R. Porter, Clerk.

(Seal Sanitary District of
Chicago, State of Illinois.)

THE SANITARY DISTRICT OF CHICAGO
Security Building

Board of Trustees
William H. Baker,
Joseph C. Braden,
Zina R. Carter,
Frank X. Clidt,
Alex. J. Jones,
William Legner,
Thomas A. Smith,
Thomas J. Webb,
Frank Wenter.

"To the Honorable Elihu B. Root,
Secretary of War,
Washington, D. C.
Dear Sir:

This being the closed season of navigation and no vessel interest being jeopardized by an increased current in the Chicago River, we feel it to be in line with the duty we owe to the citizens of Chicago and the obligation which rests upon us to use every endeavor to comply with the State law which brought the Sanitary District into existence, to request you to grant us permission to increase the flow through the Chicago River from 250,000 cubic feet per minute to 350,000 cubic feet per minute. We ask this in the interest of the health of the people of Chicago. The work of this District for construction, right of way, administration and interest has already cost our citizens $41,000,000; and other millions are being expended in the work of deepening and widening the Chicago River and substi-

tuting bascule bridges for the obstructive center pier structures which are so harmful to navigation. Our wish is, by introducing the largest possible volume of water from the lake during the closed season of navigation, to draw into the channel the largest amount of contamination that can be reached by the current thus introduced. As you know, for long years the discharge of our sewers has been into the lake and the resulting foul sediment defiles the shore line for miles of frontage. When storms, such as we have recently been subjected to, churn up this slimy deposit it often drifts out to our waters intakes making our water supply inpalatable and unhealthful. The more of this turbid water that we can draw into our channel, the better for the health of our people and the sooner shall we be able to carry off the accumulations of sewage deposit which line our shores. We are working with a steadfast purpose of making the Chicago River what it ought to be as a navigable stream and we feel a justifiable pride in what we have already accomplished in that direction.

"We are now in the courts condemning lands for widening and deepening the river which will cost this District enormous sums of money, which we will gladly pay to hasten the results we have set out to attain.

"We recognize your responsibility as the guardian of the interests of navigation but we believe that you will readily admit that even such vast interests ought and must make concessions to conserve the health of two millions of people and we shall hope for your favorable action upon our petition.

Very respectfully,

(Signed) THOMAS A. SMYTH,
JOS. C. BRADEN,
ZINA R. CARTER,
THOMAS J. WEBB,
FRANK X. CLOIDT,
FRANK WENTER,
WM. H. BAKER,
WM. LEGNER,
ALEX J. JONES."

Doc. 21. Ex. 12. Tr. 296-298.

Application of the Sanitary District of Chicago.

"Respectfully forwarded to the Chief of Engineers, with the recommendation that the petition be granted for the season closed to navigation; that is, that the flow of 350,000 cubic feet per minute be authorized until March 31st next, after which it shall be reduced to 250,000 cubic feet per minute, as now authorized.

O. H. ERNST.

"Lieut. Col., Corps of Engineers, Division Engineer, N. W. Div."

Ex. 12. Doc. 22. Tr. 301.

Recommendation of U. S. Division Engineer.

"2nd indorsement,

OFFICE CHIEF OF ENGINEERS
U. S. ARMY,

"January 5, 1903.

"Respectfully forwarded to the Secretary of War Concurring in the recommendation of Lieutenant Colonel Ernst in 1st indorsement hereon.

"By instrument dated December 5, 1901, the Secretary of War granted the Sanitary District of Chicago permission to regulate the discharge of water into the drainage canal so that the maximum flow through the Chicago River should not exceed 250,000 cubic feet per minute throughout the 24 hours of the day.

G. S. GILLESPIE,

Brig. Gen. Chief of Engineer, U. S. Army.

"35242 Incls. 69 and 74 accompanying.

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"Recd. Jan. 5-1903. Record Div. War Dept. Judge Advocate Gen."

Ex. 12. Doc. 23. Tr. 301.

Recommendation of Chief of Engineers.

"Whereas, under date of December 5, 1901, by an instrument supplementary to the original permission granted by the Secretay of War, May 8, 1899, to the Sanitary District of Chicago to open the artificial channel from Robey Street, Chicago, to Lockport, and cause the waters of the Chicago River to flow into the same, the Secretary of War, pursuant to authority reserved in said permission of May 8, 1899, gave permission to the Sanitary District of Chicago to regulate said discharge so that the maximum flow through the Chicago River shall not exceed 250,000 cubic feet per minute throughout the twenty-four hours of the day, upon the following condition, *inter alia:*

'That the permission herein given shall be subject to such modification as in the opinion of the Secretary of War the public interests may from time to time require:'

And Whereas, The said Sanitary District of Chicago has applied for permission to increase the flow through the Chicago River from 250,000 cubic feet per minute to 350,000 cubic feet per minute during the closed season of navigation, in order to carry off the accumulations of sewage deposit which line the shores along said city:

"Now, Therefore, This is to certify that, in accordance with the recommendation of the Chief of Engineers, the Secretary of War hereby gives unto said Sanitary District of Chicago permission to increase the flow through the Chicago River from 250,000 cubic feet per minute to 350,000 cubic feet per minute, until the 31st day of March, 1903, after which date it shall be reduced to 250,000 cubic feet per minute, as now authorized, upon the following conditions:

"1.—That the permission herein given shall be subject to such modification as in the opinion of the Secretary of War the public interests may from time to time require.

"2.—That said Sanitary District of Chicago shall be responsible for all damages inflicted upon navigation interests by reason of the increase in flow herein authorized.

WITNESS my hand this seventeenth day of January, 1903.

WM. LANGER,

(Seal) *Assistant Secretary of War.*"

Doc. 24. Ex. 12, Tr. 302-304.

Permit of January 17, 1903.

"THE SANITARY DISTRICT OF CHICAGO,
AMERICAN TRUST BUILDING,
Chicago,

Nov. 23, 1906.

Col. W. H. Bixby,
Corps of Engineers, U. S. A.,
Federal Building,
City.

Dear Sir:

By order of the Board of Trustees of the Sanitary District of Chicago, I have the honor to transmit herewith copy of the permit desired from the Secretary of War.

Yours very truly,

ROBERT R. MCCORMICK,
President.

Doc. 29. Ex. 12, Tr. 322-323.

WAR DEPARTMENT
Office of the Chief of Engineers
Washington

January 16, 1907.

MEMORANDUM.

In the matter of the application of the Sanitary District of Chicago to reduce the flow of the Calumet River:

It is understood to be the ruling of the Secretary of War that the act of Congress approved June 29, 1906, pro-

viding for the control and regulation of the waters of Niagara River, does not apply to the subject matter of this application, but that the project presented by the Sanitary District of Chicago comes within the purview of Section 10 of the river and harbor act of March 3, 1899. That the latter law is applicable appears unquestionable, and it may not be inappropriate to consider the extent and scope thereof.

The essence of section 10 is contained in the first clause, and its obvious purpose is to prevent the erection of any structures, the execution of any work, or the doing of any act, that would tend to obstruct, injure, diminish, or destroy the navigable capacity of any of the navigable waters of the United States, without the explicit assent of Congress.

To better accomplish this purpose, the section makes it unlawful to commence the construction of any structure, or in any manner to alter or modify the course, location, condition or capacity of any navigable water, unless such work has been previously approved or authorized by the Chief of Engineers and the Secretary of War. The effect of this latter is to necessitate the submission of every project of this kind to the Chief of Engineers and the Secretary of War for their consideration, and to impose upon them the duty of determining whether such project will or will not obstruct navigation or injure the navigable capacity of public waterways. The powers delegated to these officials are merely conservative, and intended to facilitate the execution of work that, in their judgment, would be an aid to commerce, Congress having expressly reserved to itself the power to authorize impediments and to determine to what extent the interests of commerce and navigation may be sacrificed, or yielded, in favor of other interests.

The above interpretation of the provisions of section 10 of the act of March 3, 1899, has been uniformly held by the Department, and it would seem that in considering the application of the Sanitary District of Chicago the first question to be determined should be as to the effect of the project upon the navigable waterways involved.

If, in the opinion of the Department, the project is one which fairly and directly tends to obstruct, that is, (using the language of the Supreme Court), interfere with or diminish, the navigable capacity of any public stream or waterway, the Department has no power to grant the application, and the applicant should be remitted to Congress.

The project involves the abstraction and diversion of water from Lake Michigan, and while it is impracticable to state with exactness the effect of this diversion, it is impossible to escape the conclusion that it will cause a lowering of lake levels to a considerable extent, and that this will fairly and directly tend to diminish the navigable capacity not only of the lakes themselves, but of their connecting waters, and of the vast and growing commerce contiguous to these waters.

In view of the foregoing, no executive officer can authorize the execution of the proposed work, and the action of the Department on the application should be limited to advising the applicant that the project is one that requires the sanction of Congress.

A. MACKENZIE,
Brig. Gen. Chief Engr's.

Doc. 31, Ex. 12, Tr. 330-333.
Memorandum, Chief of Engineers.

1st Indorsement.
War Department
Office of the Chief of Engineers,
Washington

February 23, 1907.

1. Respectfully returned to the Secretary of War.

2. The subject of the abstraction of water from Lake Michigan has been elaborately investigated by the Lake Survey office at Detroit, and the results are published in the annual reports of the Chief of Engineers for the years 1900, 1902 and 1904. The International Waterways Com-

mission has also given it careful consideration, and its conclusions are set forth in report of January 4, 1907, printed as War Department Document No. 293.

3. In my opinion, this abstraction will undoubtedly lower the levels of all the waters of the Great Lakes, except those of Lake Superior, and thus diminish the navigable capacity and depth of the various channels and harbors which have been deepened and improved under authority of Congress.

4. Leaving out Lake Superior, there are more than 100 works of river and harbor improvement on the Great Lakes and their connecting waters, for which appropriations aggregating more than 80 millions of dollars have been made. The application of this vast sum has resulted in securing and maintaining specified depths and widths of channel, which Congress has decided to be required for the accommodation of the traffic using these waters.

5. To diminish these depths, even to a slight extent, would not only prove a serious injury to the traffic, but would practically undo the work which has been accomplished by Congressional direction, and necessitate the expenditure of further large sums of money for restoration. Any project that tends, in a measure, to annul or reverse the orders of Congress, as expressed in the various river and harbor acts appropriating funds for improving the harbors and channels connecting with the Great Lakes, should meet the disfavor of the Department, unless it has been sanctioned by that body. In my judgment, such a project is the one under consideration, and for this reason I am unwilling to recommend favorable action thereon, assuming that the Department is empowered to take such action, as is held by the Judge-Advocate General.

A. MACKENZIE,

Brig. Gen. Chief of Engineers, U. S. Army.

Doc. 31, Ex. 12, Tr. 334-336.

Recommendation of Chief of Engineers.

WAR DEPARTMENT

Washington

March 14, 1907.

In the matter of the application of the Sanitary District of Chicago to reduce the flow of the Calumet River:

This application is made under section 10 of the Act of March 3, 1899 (30 Stat. L. 1151), which provides as follows:

Sec. 10. That the creation of any obstruction not affirmatively authorized by Congress, to the navigable capacity of any of the waters of the United States is hereby prohibited; and it shall not be lawful to build or commence the building of any wharf, pier, dolphin, boom, weir, breakwater, bulkhead, jetty, or other structures in any port, roadstead, haven, harbor, canal, navigable river or other water of the United States, outside established harbor lines, or where no harbor lines have been established, except on plans recommended by the Chief of Engineers and authorized by the Secretary of War; and it shall not be lawful to excavate or fill, or in any manner to alter or modify the course, location, condition, or capacity, of any port, roadstead, haven, harbor, canal, lake, harbor of refuge, or inclosure within the limits of any breakwater, or of the channel of any navigable water of the United States, unless the work has been recommended by the Chief of Engineers and authorized by the Secretary of War prior to the beginning the same.

The application of the Sanitary District is for leave to reverse the flow in the Calumet River in such a way as to make the water to flow out of the lake instead of to flow into it and to discharge the water from the Calumet River into the drainage canal. The Chief of Engineers was at first of opinion that such a change in the flow of the river, it was not within the power of the Chief of Engineers to recommend, or within the power of the Secretary of War to permit. This expression of opinion as to the construction of the statute was submitted to the Judge Advocate General, who holds that Section 10, as quoted above, ap-

plies to this case and that it is one in which the work could be allowed under the recommendation of the Chief of Engineers and the permission of the Secretary of War. Upon the construction of the Judge Advocate General I requested the Chief of Engineers to make his recommendation, which he has done as follows:

* * * * *

It is quite evident from the reading of the statute that Congress intended in this statute, as in many others, to give the Chief of Engineers authority, independent of the Secretary of War, in reaching a conclusion as to the wisdom and propriety of granting a permit under the section, and that unless the Chief of Engineers shall recommend the granting of the permit the Secretary of War is without power to give the requested authority. It follows, therefore, that the application must be denied whatever my view of the case.

The decision of the Chief of Engineers and its final character has made it unnecessary for me to consider the merits of the question, but I may say this much, that the application for a change in the Calumet River is to be made the basis for the withdrawal of a large amount of water from Lake Michigan and that all interested in the enormous lake traffic view the settlement of the question with grave apprehension.

Added to this is the international complication which is likely to arise in the threatened lowering of the lake level in the ports and harbors and canals of Canada.

On the other hand, it is maintained with great emphasis and elaboration of detail that the change in the Calumet River is essential to the healthful sanitation of Chicago, and that the threatened injury to navigation is so small as to be negligible.

Between two such great interests, the decision must be affected more or less by large public policy and expediency, and while I agree in the construction of the Judge Advocate General that the issue is left by statute to the recommendation of the Chief of Engineers and the concurrent decision of the Secretary of War, it may be fortunate

that circumstances now require submission of this question of capital and national importance to the Congress of the United States.

W. H. TAFT,
Secretary of War.

Doc. 32. Ex 12, Tr. 336-342.

Opinion of Secretary of War Taft.

THE SANITARY DISTRICT OF CHICAGO
AMERICAN TRUST BUILDING
CHICAGO, ILL.

ROBERT R. McCORMICK, *President.*
HOYT KING, *Real Estate Agent.*
ISAAC J. BRYAN, *Clerk.*
GEORGE H. WISNER, *Chief Engineer.*
CHARLES L. HUTCHINSON, *Treasurer.*
EDWARD B. ELLIOTT, *Electrical Eng.*
JOHN C. WILLIAMS, *Attorney.*

Jan. 10, 1910.

To the Honorable,
The Secretary of War,
Washington, District of Columbia.

Sir:

The Board of Trustees, of the Sanitary District of Chicago proposes to lay out and establish a right of way, from the Main Channel of the Sanitary District of Chicago in Section fourteen (14) Township Thirty-seven (37) North Range eleven (11) East of the Third Principal Meridian to the North and South center line of Section Twenty-five (25) Township Thirty-seven (37) North Range fourteen (14) East of the Third Principal Meridian, connecting at that point with the Calumet River.

The right of way it expects to acquire will include and bisect a part of the Illinois and Michigan Canal and its ad-

jacent strip and also will include and bisect the so called 'Calumet Feeder.' It is also contemplated that said Sanitary District will use for its corporate purposes the entire so called 'Calumet Feeder.'

It is further proposed to construct and maintain along or near the center of said right of way a channel, to be known as the Calumet-Sag Channel as an adjunct to its Main Channel as now constructed.

The approximate location and grade of said Calumet-Sag Channel in the right of way which has been definitely established is shown on the accompanying map and profile —marked Exhibits 'A' and 'B.'

A copy of the Act of the Legislature of 1903 is also herewith submitted to show the authority of the District to construct said channel, marked Exhibit 'C.'

Under the plans herewith submitted it is not proposed to take any water from Lake Michigan through the Main Channel, the North Shore Channel and the Calumet-Sag Channel of the District, in excess of 10,000 cubic feet per second.

The above exhibits of the plan proposed are herewith submitted and the Board of Trustees will greatly appreciate it if you will examine and approve the same in order that work may be begun at the earliest possible date.

Yours very truly,

G. M. WISNER,

Chief Engineer.

Doc. 33, Ex. 12, Tr. 345-347.

Application of Sanitary District of Chicago.

Doc. 35—Ex 12.

2nd Indorsement

WAR DEPARTMENT

Office of the Chief of Engineers.

Washington.

March 1, 1910.

1. Respectfully forwarded to the Secretary of War.

2. The Sanitary District of Chicago requests permission to execute certain work outlined within and exhibited on the accompanying drawings. The project involves the following matters which require the consideration of the Department:

(a) Reversal of the flow of water in Calumet River;

(b) Change of hydraulic grade in Calumet River;

(c) Velocity of current that may be generated in Calumet River;

(d) Diversion of water from Lake Michigan.

3. These matters are fully discussed by Major Rees, the district engineer officer, in his letter of January 17 herewith and he reaches the conclusion that, subject to certain conditions, set forth in paragraph 7, the application may be given favorable consideration, without detriment to the interests of navigation.

4. The diversion of water from Lake Michigan is the most important question involved in this project, and on a similar application presented by the Sanitary District in 1907, the Chief of Engineers declined to recommend favorable action on account of the probable injurious effect upon the levels of the great Lakes. The position taken by this office at that time was that any project, which contemplated the permanent and continuous abstraction of water from Lake Michigan, should have the special sanction of Congress before being approved by the War Department, and the reason therefor is expressed in 1st indorsement on 12721/2 W. D. 1907, to which attention is invited.

5. The Sanitary District is now taking from Lake Michigan through the South Branch of Chicago River, into its main drainage canal, about 4166 cubic feet of water

per second, the privilege being exercised under permit from the War Department. Such privilege was originally granted, as a temporary measure, on the expressed understanding that the questions involved would be subject to such action as Congress might take. The matter was presented to Congress, but no action was taken by that body, either favorable or unfavorable, so that, so far as this diversion is concerned, the Department may logically assume that it has the sanction of Congress.

6. The project now submitted contemplates a further diversion which, inclusive of the aforesaid withdrawal through the main channel, is not to exceed 10,000 cubic feet per second. While this amount of water might possibly be withdrawn from Lake Michigan by the Sanitary District, through its various channels, without injury to navigation in Chicago and Calumet rivers and without lowering the levels of lakes Huron and Michigan more than 6 inches, nevertheless, in view of the results of even a slight reduction in the levels of these lakes, I believe that the question is one that merits the attention and consideration of Congress, and that until Congress has indicated a policy, either special or general, with respect to it, the War Department will not be justified in granting any permission or in approving any project which contemplates the permanent and continuous abstraction of water from Lake Michigan. I am therefore constrained to adhere to the views of my predecessor, and to recommend that so much of the project as covers the diversion, be not given favorable consideration, until sanctioned by Congress. As that body is now in session, a favorable opportunity is presented to obtain its action.

7. Regarding the other features of the project, I should be willing to recommend approval, if the Sanitary District desires such action at this time, and will segregate them from the undesirable feature.

W. L. MARSHALL,

Chief of Engineers, U. S. Army.

Doc. 35, Ex. 12, Tr. 353-357.

Recommendation of Chief of Engineers.

PERMIT OF JUNE 30, 1910.

Washington, June 30, 1910.

Sir: Referring to your application of the 27th instant on behalf of the board of trustees of the Sanitary District of Chicago to open a channel from the Calumet River to its existing main channel so as to substitute two routes instead of one between Lake Michigan and its canal, I have the honor to advise you to the following effect:

It appears from the records of the department that by an instrument executed May 8, 1899, the Sanitary District of Chicago was given permission to connect its drainage canal with the South Branch of the Chicago River at Robey Street, in the city of Chicago, and to divert the waters of Lake Michigan through the Chicago River into said canal subject to certain specified conditions designed to limit the amount of such diversion and in other ways to protect the public interest. The permission so granted was subsequently modified at various times, and by an instrument executed December 5, 1901, the amount of flow was fixed at not exceeding 250,000 cubic feet per minute equivalent to 4,167 cubic feet per second, which is the present rate allowed. At the time the original permit was given, a connection with the Calumet River was not mentioned, but if it had been it is probable that a connection with that river as well as with the Chicago River would have been allowed.

So long as the water flow remains unchanged there seems to be no special objection to its extension to both rivers instead of confining it to a single one, especially since if the new (Calumet) route be developed later to a navigable state the double route will be advantageous to navigation interests. Accordingly, in view of the favorable recommendation of the Chief of Engineers and of the consent thereto by the Attorney General, under the conditions hereinafter prescribed, the department hereby modifies the existing permission so as to allow the diversion of the already permitted water flow in such a manner as to reach the sanitary district canal by way of the Calumet river and a connecting channel, as well as by way of its present route through the Chicago River, subject to all pertinent conditions of the existing permissions and to other express conditions, as follow:

(a) That it be distinctly understood that it is the intention of the Secretary of War to submit the questions connected with the work of the Sanitary District of Chicago to Congress for consideration and final actions, and that this permit shall be subject to such action as may be taken by Congress.

(b) That if at any time it becomes apparent that the current created by such drainage work in the Calumet as well as Chicago Rivers be unreasonably obstructive to navigation, or injurious to property, the Secretary of War reserves the right to close the discharge through said channels or rivers, or to modify it to such an extent as may be demanded by navigation and property interests along said rivers.

(c) That the Sanitary District of Chicago must assume all responsibility for damages to property and navigation interests by reason of the introduction of a current in the Calumet as well as Chicago Rivers.

(d) That the amount of water withdrawn from Lake Michigan, through the Chicago and Calumet Rivers together, shall not exceed the amount of 250,000 feet per minute (4,167 cubic feet per second) already authorized to be withdrawn through the Chicago River alone.

(e) That the permission herein given shall be subject to such modification as in the opinion of the Secretary of War the public interests may from time to time require.

(f) That this permission shall in no wise affect or in any manner be used in the friendly suit now pending in the Circuit Court of the United States for the Northern District of Illinois, brought by the United States of America against the Sanitary District of Chicago, to determine the right of the said sanitary district to divert from Lake Michigan for sanitary purposes an amount of water in excess of that now being diverted without having first obtained a permit from the Secretary of War.

(g) That the War Department shall have free access at all times to the water-flow records of the Sanitary District of Chicago, and free access also to the regulating works and all other parts of its canals for the purpose of checking records or making water-flow measurements.

(h) That the plans for the proposed work shall be submitted to and approved by the Chief of Engineers and the Secretary of War.

(i) That the work shall be subject to the supervision and approval of the Engineer officer of the United States Army in charge of the Locality.

Very respectfully,

ROBERT SHAW OLIVER,
Acting Secretary of War.

Doc. 37, Ex. 12, Tr. 363-366.

Permit of June 30, 1910.

THE SANITARY DISTRICT OF CHICAGO

American Trust Building
Engineering Department. Telephone Central 624.
Chicago, February 5th, 1912.

Feb. 7, 192..
War Department.

Sir:

On behalf of the Board of Trustees of the Sanitary District of Chicago, I have the honor to apply for enlargement of the terms of an instrument executed by the Secretary of War May 8, 1899, as modified by instruments similarly executed on December 5, 1901, and June 30, 1910, respectively, in the following particulars and in view of the facts hereinafter set forth, to wit:

The flow of water from Lake Michigan through the canal of the Sanitary District of Chicago is now limited by the said instruments to 4,167 feet per second.

The population of the Sanitary District, the sewage of which is to be disposed of through the channels constructed and to be constructed by the said District, exceeds 2,500,000 persons, and is rapidly increasing. The only method at present available for disposing of the sewage of this population is by diluting the same with water withdrawn from Lake Michigan and flowing through the

Chicago Drainage Canal. The least amount of water necessary to render sewage innocuous by the dilution method has been estimated by well recognized sanitary experts as 1,000 feet per second for every 300,000 inhabitants; so that the amount permitted to be withdrawn by the instruments to which reference has been made is much below the amount at present needed by the District.

The Sanitary District has been for some time engaged in investigating methods and devising plans for the treatment of the sewage with a view to requiring less water for its safe dilution in the future. The methods of other states and countries for such treatment of sewage, are not as yet entirely satisfactory to all concerned, and any changes of methods for large cities must necessarily require several years.

Until these experiments are concluded and proper works installed, the use of additional water from Lake Michigan is essential to the health of the large population of the City of Chicago and of the Sanitary District and of those who live adjacent to the Des Plaines and Illinois rivers into which such waters are discharged.

Subject therefore to such restrictions as to you may seem proper for the protection of the public interest, and to such a method of supervision as you may suggest to promote the general welfare, and pending the completion of the investigations now being conducted to render the use of increasing quantities of water in the future unnecessary; I have the honor to apply for permission for the Sanitary District of Chicago to withdraw from Lake Michigan through the Chicago river and Calumet river—not to exceed ten thousand cubic feet of water per second; such permission to be revocable at any time by the Secretary of War, and subject to such action as the Congress of the United States may see fit to take in the premises.

Respectfully submitted,

GEORGE M. WISNER,

Chief Engineer.

Doc. 38, Ex. 12, Tr. 367-369.

Application of Sanitary District of Chicago.

WAR DEPARTMENT
UNITED STATES ENGINEER OFFICE
508 Federal Building
Chicago, Ill., Mar. 11, 1912.

The Chief of Engineers, U. S. Army.
Washington, D. C.

Sir:

I have the honor to inclose herewith a memorandum prepared as indicated herein, with request that it be transmitted to the Secretary of War.

This memorandum is not intended to be a full discussion of the subject such as has been presented in Document No. 6, 59th Congress, 1st Session, Committee on Rivers and Harbors points that were brought up in conversation with the Secretary, and which he requested should be called to his attention by a memorandum.

Very respectfully,

GEO. A. ZINN,
Lt. Col. Corps of Engineers, U. S. A.

1ST INDORSEMENT. WHB/WSH
War Department
Office of the Chief of Engineers
Washington
March 26, 1912.

1. Respectfully submitted to the Secretary of War, as presenting the personal views of Lieutenant Colonel Zinn, the district engineer officer at Chicago.

2. In the main, these views accord with the past and existing views of the Engineer Department in general and the Chicago office in particular.

W. H. BIXBY,
Chief of Engineers, U. S. Army.

Chicago, Ill., March 11, 1912.

Memorandum prepared in the U. S. Engineer office, Chicago, Ill., in accordance with the verbal instructions of the Secretary of War March 6, 1912, on the matter of the application of the Sanitary District of Chicago to divert 10,000 cubic feet of water per second from Lake Michigan.

The Secretary of War is asked to grant a permit for the withdrawal of 10,000 cubic feet of water from Lake Michigan through the Main Sanitary Canal which terminates near Lockport, Illinois, and discharges into the Des Plaines River at that point, from the Des Plaines River thence into the Illinois River.

Has the Secretary of War jurisdiction in this matter and has he authority to issue such a permit? If it is determined that the Secretary of War has jurisdiction and the necessary authority, the issuance of this permit will then depend upon the relative advantages and disadvantages, benefits and injuries which will follow the granting or withholding of it.

The jurisdiction of the Secretary of War over the navigable waters of the United States is derived from special and general legislation. The general legislation is found in the River and Harbor act approved March 3, 1899, which defines the duties of the Secretary of War and determines the extent of his jurisdiction. It may be inferred that the jurisdiction of the Secretary of War is limited to the items named in that act. Under that act he may order the removal of bridges obstructing navigation, remove wrecks interfering with navigation, establish harbor lines when essential to the preservation and protection of harbors, authorize the creation of obstructions and the alteration of navigable channels in the navigable waters of the United States. Under the river and harbor act of August 18, 1894, it is the duty of the Secretary of War to prescribe rules and regulations for the use, administration and navigation of any and all canals and similar works of navigation that are now or may hereafter be owned and operated by the United States. He is also

authorized to prescribe regulations covering the speed and movement of vessels and the opening of draw bridges. The acts of May 9, 1900 and March 3, 1905, further increase the jurisdiction of the Secretary of War over navigable waters. Section 10 of the act of March 3, 1899, may perhaps be interpreted to confer upon the Secretary of War the necessary authority to grant the application of the Sanitary District, although if it be shown that the granting of the application will create an obstruction "not affirmatively authorized by Congress" the Secretary has no authority in the case.

It would appear that the War Department entertained a doubt as to its authority from the language used in the two permits issued under date of July 11, 1900 (E. D. 35041/17 and 18), granting permission to the Sanitary District of Chicago to change, alter and improve the Chicago river. Condition 1 of both of these permits states:

That it be distinctly understood that it is the intention of the Secretary of War to submit the questions connected with the work of the Sanitary District of Chicago to Congress for consideration and final action and that this permit shall be subject to such action as may be taken by Congress.

Let it be assumed that the Secretary of War has both authority and jurisdiction, his action in this matter, as previously stated, will be determined by weighing the relative benefits and injuries, advantages and disadvantages attached to granting and withholding the permit.

Consider the first case of withholding the permit. The City of Chicago now empties all of its sewage and refuse matter flowing from streets, both solid and liquid, into the Chicago River. There are no catch basins at the river ends of the sewers and the street catch basins are inefficient so that large quantities of solid matter necessarily flow into the Chicago River in violation of Section 13 of the River and Harbor Act of March 3, 1899. It is reported that city officials have said that it would be cheaper to dredge the river than to build catch basins. That large quantities of solid matter do go into the river from city sewers and from overflow from streets is shown in the

report of Mr. G. M. Wisner dated October 12, 1911, to the Board of Trustees of the Sanitary District of Chicago, in which Mr. Wisner states that the Main Sanitary Canal has been filled to the extent of about 2,340,000 cubic yards which fill must be removed to restore the main channel to its proper capacity. Some shoaling is known to have taken place in the Chicago River after the river was dredged by the United States and the Sanitary District.

The present allowance (permit of Dec. 5, 1901) of 250,000 cubic feet per minute (4,167 cu. ft. per second) is not sufficient to properly dilute and carry off the sewage of the present population of the Sanitary District of Chicago, which includes the City of Chicago and some outlying territory. With the constantly increasing population of the Chicago region, it is evident that there will be a constantly repeated demand for more water for dilution. Many large cities at home and abroad have found themselves obliged to abandon the dilution method. It is not only possible for the Sanitary District to dispose of its sewage without an increase in its present allowance, but also imperative for it to adopt another system; if not now then in the near fuuture. Other systems are available which will not require an increase in the present allowance.

Again, the adoption of some other system will not result in or require the abandonment of the existing channels and works of the Sanitary District.

Under present conditions, the Sanitary District cannot make use of 10,000 cu. ft. per second without creating a current in the Chicago River which will be injurious to navigation. The 10,000 cubic feet required can only be used without injury to navigation after the Sag Canal and other works contemplated for the removal of sewage in the Calumet region, recently placed under construction, have been completed, which event is not expected to take place within several years. The Sanitary District officials admit that they are now withdrawing about 7,000 cubic feet per second from Lake Michigan, the excess above 4167 ft. per second being in violation of the terms of their permit. The current now existing in the river is injurious to navigation, as shown by collisions between vessels and bridges

and the difficulty of stemming the current. The withdrawal of water from Lake Michigan has undoubtedly resulted in a permanent lowering of the water surfaces of all the Great Lakes.

At present the War Department has no practical means for determining the amount of water drawn from Lake Michigan. Effective supervision over the operations of the Sanitary District will be difficult and expensive.

The practical effect therefore of withholding an increased allowance will be to force the Sanitary District of Chicago and the City of Chicago to adopt another system of sewage disposal, or a combination of the present system with another system.

Consider now the effect of granting the application of the Sanitary District.

As just stated, the increased allowance cannot be used immediately without injury to navigation in the Chicago River, and the temptation to use it will be very great, as the Sanitary District has up to now succeeded in escaping punishment for its offenses against the United States and navigation interest.

When the Sag Canal is completed and the 10,000 cubic feet per second may be withdrawn without producing injurious currents in the Calumet and Chicago rivers, the other effect, previously referred to, of lowering the lake surfaces of the Great Lakes will be greatly increased, resulting in lesser depths in all lake channels and harbors, greatly diminished carrying capacity in vessels, etc.—an injury which, measured in dollars and cents, will equal in a very few years the total cost of a new sewage system for the City of Chicago.

Has the Secretary of War authority to permit such injury even should he so desire?

There seems to be no question of the right of the United States to divert water flowing in navigable streams from one place in the stream to another place in the same stream for the benefit of navigation. See case of *South Carolina v. Georgia, et al.,* (3 Otto 4). The right of an individual, a State, or the United States to divert water from navigable streams or bodies to non-navigable streams has not been adjudicated to my knowledge.

It may be asserted that the diversion of water in the present case is from one navigable body of water (Lake Michigan) to another (Illinois River). The diversion, while beneficial, is not necessary for the improvement of navigation on Illinois River or Lake Michigan. The right of the State of Illinois to use water from Lake Michigan for purposes of navigation in its Illinois and Michigan Canal, connecting Lake Michigan and the Illinois River, has not been questioned, but the quantity used is practically nothing. Whether the diversion of water for navigation purposes in the Illinois and Michigan waterway in sufficiently large quantities to injure navigation on the Great Lakes would be legal or proper remains to be determined.

The granting of the permit applied for by the Sanitary District would result in an immediate and vast injury to navigation on the Great Lakes and would be of only temporary benefit to the Sanitary District of Chicago. Moreover, it appears to be a question that can properly be determined only by the Congress of the United States.

It is reported that 650,000,000 gallons of water per day are pumped from Lake Michigan by the various water works of the City of Chicago into its water supply system. A very small quantity of this amount of water returns directly to the lake and the rest being discharged from streets and sewers into the Chicago River. This quantity is equal to 1.005 cu. ft. per second and it is presumed that this withdrawal of water is included in the quantity to be withdrawn by the Sanitary District of Chicago.

Attention is invited to Article 111, Treaty between the United States and Great Britain—Boundary waters between the United States and Canada, Proclaimed May 13, 1910, which reads as follows:

It is agreed that, in addition to the uses, obstructions, and diversions heretofore permitted or hereafter provided for by special agreement between the parties hereto, no further or other uses or obstructions or diversions, whether temporary or permanent, of boundary waters on either side of the line, affecting the natural level or flow of boundary waters on the other side of the line, shall be made except by authority of the United States or the Dominion of Canada within their respective jurisdictions and with

the approval, as hereinafter provided, of a joint commission, to be known as the International Joint Commission.

The foregoing provisions are not intended to limit or interfere with the existing rights of the Government of the United States on the one side and the Government of Canada on the other, to undertake and carry on governmental works in boundary waters for the deepening of channels, the construction of breakwaters, the improvement of harbors, and other governmental works for the benefit of commerce and navigation, provided that such works are wholly on its own side of the line and do not materially affect the level or flow of the boundary waters on the other, nor are such provisions intended to interfere with the ordinary use of such waters for domestic and sanitary purposes.

GEO. A. ZINN,
Lieut. Col., Corps of Engineers.

Doc. 39, Ex. 12, Tr. 371, 373, 374-382.

Report of U. S. District Engineer upon Application of Sanitary District.

WAR DEPARTMENT
OFFICE OF THE CHIEF OF ENGINEERS

Washington,

February 28, 1912.

MEMORANDUM FOR THE SECRETARY OF WAR: (As to the Sanitary District diversion of water from Lake Michigan, through the Chicago River, Sanitary District Canal, Illinois River to the Mississippi Valley.)

There are several special features of this Chicago Sanitary District diversion and Illinios River power and waterway proposition which need special explanation to any one studying the proposition.

For the purposes of navigation alone by canal and canalized river from Lake Michigan to the Mississippi River, on the Illinois River and its headwaters and connecting canals and to keep the locks and pools full, a diversion

from Lake Michigan of less than 1,000 second-feet of water will easily supply any reasonable demands and is all that will be actually necessary; and any greater diversion is a greater injury than benefit to navigation. The works of the Sanitary District of Chicago originally constructed mainly for purposes of sanitation, were designed to allow the diversion of 10,000 second-feet, which they now request, and they are now found to be large enough for a total diversion of 14,000 second-feet, the additional 4,000 second-feet having been requested by them and refused by the War Department a few years ago (injunction suit still in progress) the extra water to be taken from Lake Michigan through the Calumet River and a connecting canal following the Sag route. The amounts requested, while perhaps needed at the present time, will not be necessary later, after the full installation of the more modern improved methods of treating sewage. The War Department, while waiting the definite action of Congress, has so far permitted the diversion of 4,167 second-feet. The Sanitary District, by its own recent statements, is understood to be using about 7,000 second-feet. While it appears to have been assumed at times that the Sanitary District will be finally allowed by the United States to divert 10,000 second-feet so long as actually necessary for sanitary purposes, the diversion of the waters of the Great Lakes from their natural outlet so far as desired merely for aid to power development is of doubtful legality by reason of the terms of the recent treaty between the United States and Great Britain, which appears to require the approval of such a diversion by the International Joint Commission created pursuant to said treaty. The treaty enables riparian owners of Canada, as well as of the United States, who consider themselves injured by such diversion, to bring suit in United States courts to protect their interests. The treaty also, although recognizing as proper the use of water necessary for sanitary purposes, provides for action, if necessary, by the Commission after request from the United States Congress or the Canadian Parliament, and no other organization has power of final decision. It is the opinion of the Engineer Lakes to the Gulf Waterway Board (January 25, 1911),

that in view of the rights and interests of navigation, only such water should be diverted from Lake Michigan as is indispensable for sanitation, and then only with a provision for construction and maintenance of proper compensating works in the outlets of the lakes to prevent the lowering of their levels; and that although water thus diverted may be used incidentally for power purposes, great care must be exercised by the War Department, when waiving the objections of navigation to the diversion of water for sanitary purposes, to not extend such waiver beyond the amount actually necessary for sanitation alone.

Diversion of water from Lake Michigan and the St. Lawrence basin into the Illinois River and the Mississippi River basin is seriously objectionable from many standpoints, and should be permitted under the recent treaty with Canada only to such extent as is necessary for sanitation of the City of Chicago. The objections to such diversion of water are briefly as follows:

(a) The levels of Lakes Michigan, Huron, and Erie, for the last twenty years, and at the present moment, are lower than their average of the last fifty years; and their levels are now again falling. Every foot of draft in the harbors of these Lakes and in the connecting rivers—St. Marys, St. Clair, and Detroit—is exceedingly valuable to navigation and every cubic foot per second of water flow taken out of Lake Michigan in excess of its natural outflow through Lake Huron and the St. Clair River is a permanent loss to the waterflow of the St. Lawrence basin, and tends to injure navigation over the entire waterway from Lake Michigan to the Gulf of St. Lawrence. While compensating works at the outlets of Lake Huron, Lake St. Clair, and Lake Erie, and Lake Ontario may be possible to an extent sufficient to maintain the existing and past levels of these lakes they will be very expensive and cannot in any case prevent loss to the St. Lawrence basin, of any water diverted into the Mississippi basin; and any loss of water by such diversion will make necessary further expensive construction works or dams or dredging in St. Clair, Detroit, and St. Lawrence rivers in order to maintain channel depths. Moreover the same loss of water will perma-

nently injure and diminish the waterpower development capacity of the Niagara and St. Lawrence rivers.

(b) Moreover, the dumpage of sewage into rivers while heretofore allowable, is becoming more objectionable every year and is being prevented more and more every year by enactments of State legislature throughout the country. Chicago, with reference to the Illinois River, is in much the same situation as Worcester, Mass., with reference to the Blackstone River. In days long past the sewage of Worcester flowed into the Blackstone and was carried down through the States of Massachusetts and Rhode Island into Narragansett Bay. The danger and damage to the people and industries of the Blackstone River led to enactments of laws by the Massachusetts Legislature forbidding further sewage contamination of any of the State rivers, thus forcing the inland cities of Massachusetts to the disposal of sewage by modern improved methods based upon mechanical and chemical treatment. As Chicago and the cities along the Illinois River increase in population, it is to be expected that the results of the sewage contamination of the river, and the legislative action of Massachusetts will be practically duplicated in Illinois where the remedy will be possible at a lower cost per head of population; after which the diversion of large quantities of Lake Michigan water into Illinois River, being then no longer necessary for the sanitation of Chicago, and neither now nor then for navigation between Lake Michigan and the Mississippi River, and being already of detriment and serious danger to the important interests of navigation of the Great Lakes system will no longer have any reason for continuance except for local benefit inside the State of Illinois.

(c) Looked at from the point of view of conservation of water power, every cubic foot of water diverted from Lake Michigan into the Illinois River is an economic loss to the United States as a whole as well as to Canada, because the local conditions as regard river slope and fall are such that this water, if sent through the Niagara and St. Lawrence Rivers to the Atlantic can develop twice as much power in the State of New York, and, at the same

time, twice as much power in the Dominion of Canada as it can develop in Illinois if sent through the Illinios and Mississippi rivers to the Gulf of Mexico.

From the above it is evident that it is of the greatest importance to the United States that the diversion of water from Lake Michigan into the Illinois River should be limited to merely such amount as is actually indispensable to sanitation; and that the United States should reserve to itself the right to redetermine such amount every few years as local conditions change.

W. H. Bixby,

Chief of Engineers, U. S. Army.

Even on the supposition that the waterway from Lake Michigan to the Mississippi River should at some future time provide for the passage of boats of over 20-foot draft or any other greatest draft useful in the Great Lakes, such a navigation can be maintained with a diversion of Lake Michigan water less than one-fifth of that at present desired by the State authorities.

Doc. 40. Ex. 12. Tr. 383-389.

Report of Chief of Engineers.

"Washington, January 8, 1913.

"The Sanitary District of Chicago applies to the War Department for permission to increase the amount of water it is authorized to withdraw from Lake Michigan from 4,167 cubic feet per second, the amount now authorized, to 10,000 cubic feet per second.

"The Chicago Drainage Canal was opened in January, 1900. It reverses the flow of the Chicago River, which formerly emptied into Lake Michigan, and as a result a portion of the waters of that lake, instead of following their former course through Lakes Huron, Erie and Ontario into the St. Lawrence, are now carried across the watershed into the Illinois River, and through that to the Mississippi and the Gulf of Mexico. The canal thus serves as a system of drainage for the City of Chicago, carrying the sewage of

that city southward to the Mississippi, and thus protects the water supply of that city, which is taken from Lake Michigan.

"Permission to divert water from Lake Michigan was first granted by my predecessor, Secretary Alger, on May 8, 1899. He permitted a flowage of 5,000 cubic feet per second, but his permit contained the following conditions:

"1. That it be distinctly understood that it is the intention of the Secretary of War to submit the questions connected with the work of the Sanitary District of Chicago to Congress for consideration and final action, and that this permit shall be subject to such action as may be taken by Congress.

"2. That if, at any time, it becomes apparent that the current created by such drainage works in the south and main branches of Chicago River be unreasonably obstructive to navigation or injurious to property, the Secretary of War reserves the right to close said discharge through said channel or to modify it to such extent as may be demanded by navigation and property interests along said Chicago River and its south branch.

"Subsequently, during the administration of Secretary Root, the amount of the current permitted to be taken was modified or restricted until December 5, 1901, when it was fixed at the amount now permitted, and these permits contained the condition:

that the permission herein given shall be subject to such modifications as in the opinion of the Secretary of War the public interests may from time to time require.

"On March 14, 1907, an application made for permission to divert an additional 4,000 cubic feet per second for the purpose of reversing the current of the Calumet River and flowing that river also through the canal to drain the southern portion of Chicago was denied by Secretary Taft in an opinion in which he referred once more to the desirability of submitting "this question of capital and national importance to the Congress of the United States."

"It is clear that even under the conditions heretofore manifested on these applications, the proposition to divert

the waters of Lake Michigan into another watershed has not been entertained without hesitation and careful restriction by my predecessors. The propriety of obtaining congressional sanction for the project has been pointed out from the beginning; and the form in which the permit has been granted, even for the moderate amount of diversion permitted, has been so phrased as to indicate that the permission was predicated upon the absence of any substantial injury to commerce.

"The sanitary canal has never received the direct sanction of Congress. It was built solely under the authority of the State of Illinois, as given in its 1889 general act for creating sanitary districts. And although pursuant to the suggestion of my predecessors the question of the propriety of its diversion of water from Lake Michigan was presented urgently in the reports of the Chief of Engineers for the years 1899 and 1900 as transmitted to Congress, no action upon the question has ever been taken by that body. In the argument before me it was urged that the present canal represented the growth and development of a national policy expressed in two acts of Congress, 1822 and 1827, which authorized the construction of a canal "to connect the Illinois River with Lake Michigan," thus connecting the two watersheds. (Acts of Mar. 30, 1822 and Mar. 2, 1827.) But these statutes authorized a canal for the purpose of navigation and not sanitation. (*Missouri vs. Illinois,* 200 U. S. 526.) The Illinois and Michigan Canal, actually constructed under their authority, derived its water for navigation purposes from the Calumet, Des Plaines, and Chicago Rivers, and not from the Lakes. And although in the latter part of its existence it was used to a very slight extent to help purify the waters of the Chicago River and thus sanitate the City of Chicago, such a purpose could not have been dreamed of at the time its construction was authorized by Congress, 90 years ago. I cannot see that its authorization and construction offer the slightest congressional sanction for the great canal now under discussion, which was not even contemplated until much more than half a century later. Even at the time when the present canal was constructed and opened it is

very evident that its ultimate possible effect upon the navigation of the Great Lakes was not clearly realized by those interested in that navigation. The evidence before me indicates that the withdrawal of water from Lake Michigan at Chicago would require about five years to produce its full effect upon the levels of the Great Lakes (see report of International Waterways Commission on Chicago Drainage Canal, p. 7) and that this effect would be still further obscured by periodic oscillations in the lake levels. These facts may easily explain any inaction on the part of the Nation and their representatives to this withdrawal of water and make it clear that any argument of applied acquiescence must be scrutinized with unusual care.

"In this respect the situation is now very different. The present application was opposed by representatives of 23 Cities and 6 States interested in harbors and commerce upon the Great Lakes, notably the Cities of Duluth, Milwaukee, Toledo, Cleveland and Buffalo. It was opposed by representatives of the navigation interests engaged on the Chicago River as well as on the Great Lakes; and by the official representatives of the Canadian Government as well as private Canadian interests engaged in the navigation of the Lakes and the St. Lawrence River, including representatives of the Cities of Kingston and Montreal.

"A very careful consideration of the voluminous evidence and statements submitted, as well as a consideration of the reports of other commissions and boards of engineers who have investigated the subject, leaves no doubt in my mind that the withdrawal of 10,000 cubic feet per second would substantially interfere with the navigable capacity of the Great Lakes and their connecting rivers. The Chief of Engineers, whose statutory authority in passing upon this application is concurrent with and independent of my own, and whose opinion upon such a question of scientific conclusion must be given especial weight, so states in his recommendation. His conclusions are corroborated by the authority of other boards of investigation, notably the report of the International Waterways Commission of January 4, 1907.

"Careful observations and calculations conducted under the offices of the United States Lake Survey and reported through the Chief of Engineers, covering observations for the last 46 years, indicate that a withdrawal of 10,000 cubic feet per second would reduce levels at various places as follows:

	Inches.
Lakes Huron and Michigan	6.9
Lake St. Clair	6.3
Lake Erie	5.4
Lake Ontario	4.5
St. Lawrence River and Rapide Plat	4.8 Plus

"The foregoing effects would be produced at mean lake levels; the lowering effects would be much greater at low-water periods—the precise time when any additional shortage would be most keenly felt. This reduction would create substantial injury in all of the American harbors of the Great Lakes and in the St. Marys, St. Clair and Detroit Rivers. It would produce equal injury in Canadian harbors on the Great Lakes, and a still greater injury on the lower St. Lawrence, the Canadian officials claiming a probable lowering effect of 12 inches at Montreal at low water.

"The United States has improved about 106 harbors and rivers on the Great Lakes affected by this diversion and has spent on such improvement over ninety millions of dollars. The Canadian Government has improved over 50 harbors on Georgian Bay and Lakes Huron, St. Clair, Erie and Ontario. By treaty, American vessels are accorded equal rights of navigation with Canadian vessels in all these waters, including the St. Lawrence River. The reduction of the water in these harbors and channels would diminish to just that extent the amounts of these improvements, and would nullify to just that extent the effects of the moneys which have been appropriated for that purpose by the respective Governments. Connecting various portions of these waterways are the two canals at the Sault Ste. Marie, the Welland Canal, and a number of canals on the St. Lawrence River. The available depth of

water over one or all sills of each of these canals would be affected, and in some cases reconstruction might even be made necessary.

"The enormous lake traffic which uses these harbors and these rivers is increasing with great rapidity, both in gross volume and in the size and average draft of the vessels employed therein. The Chief of Engineers reports that to lower the water surface 6 inches would reduce the permissible load of one of the large modern vessels by from 300 to 550 tons, with a consequent loss of from $3,600 to $7,500 in freights for such vessel per season. The International Waterways Commission reported that it would be a conservative estimate which would make the loss to the navigation interests resulting from a reduction of 6 inches in the depth of water as $1,500,000 per annum, or a sum which, capitalized at 4 per cent, would amount to a loss of $37,500,000 (see third progress report of International Waterways Commission of Dec. 1, 1907, p. 24.) The lowest careful estimate of injury to American vessels alone is reported by the Chief of Engineers at $1,000,000 per year.

"The argument was made before me that, owing to the well-known fact that the levels of the lake vary, owing to winds and change of barometric pressure, by amounts even greater than the reduction which would be caused by this canal, therefore the proposed reduction is of no consequence. This argument is well disposed of in the report of the International Waterways Commission of January 4, 1907, on page 8 as follows:

" 'It is evident that the average level of the lake may be lowered considerably without the change becoming immediately apparent, and that fact has been used as an argument to prove that the lowering caused by the Chicago Drainage Canal is of no consequence to those interested in navigation. Since they cannot see it they will not know it and will not feel it. The argument is fallacious. It is true that they cannot see it immediately, but they will soon feel it and will know it through the most costly means of acquiring knowledge—the injury to their material interests. The oscillations will remain the same as before, but

low water will fall lower and high water will rise less high. The average draft of vessels must be diminished by the amount that the average level is lowered unless the depth be restored by remedial works.'

"In a word, every drop of water taken out of Chicago necessarily tends to nullify costly improvements made under direct authority of Congress throughout the Great Lakes, and a withdrawal of the amount now applied for would nullify such expenditures to the amount of many millions of dollars, as well as inflict an even greater loss upon the navigation interests using such waters.

"On the other hand, the demand for the diversion of this water at Chicago is based solely upon the needs of that city for sanitation. There is involved in this case no issue of conflicting claims of navigation. The Chief of Engineers reports that so far as the interests of navigation alone are concerned, even if we should eventually construct a deep waterway from the Great Lakes to the Mississippi over the route of the sanitary canal, the maximum amount of water to be diverted from Lake Michigan need actually be not over 1,000 feet per second, or less than a quarter of the amount already being used for sanitary purposes in the canal. This estimate is confirmed by the report of the special board of engineers on the deep waterway from Lockport, Ill. to the mouth of the Illinois River, dated January 23, 1911. It is also confirmed by the practical experience of the great Manchester Ship Canal in England. From the standpoint of navigation alone in such a waterway too great a diversion of water would be a distinct injury rather than a benefit. It would increase the velocity of the current and increase the danger of overflow and damage to adjacent lands.

"We have, therefore, presented in this case claims of entirely different characters and jurisdictions—the claim of sanitation on the one side and of navigation on the other; the vital interest of a single community on the one side and the broad interest of the commerce of the nation on the other. The discretion given to the Secretary of War under sections 9 and 10 of the act of 1899 is very broad, but I have very grave doubts as to whether

it was intended to authorize him to grant a permit which would inflict a substantial injury upon commerce in order to benefit sanitation. The entire purpose and scope of that legislation was to make him the guardian of the commercial interests of the nation represented in their waterways. And while he sometimes under that Statute must decide that the interests of one class of transportation are less important and must yield to the conflicting interests of another class, I have considerable doubt whether it was intended to give him authority to sacrifice substantial interests of navigation to entirely different claims over which he normally has no jurisdiction whatever.

"But however that may be, and without resting my decision upon the matter of my legal authority, I am quite clear as a matter of discretion that under the facts presented by this case no further diversion of water should be permitted at Chicago without the direct sanction of the Congress of the United States. I do not for one moment minimize the importance of preserving the health of the great City of Chicago; but when a method of doing this is proposed which will materially injure a most important class of the commerce of the nation and which will also seriously affect the interests of a foreign power, it should not be done without the deliberate consideration and authority of the representatives of the entire nation. The growth of Chicago is phenomenal and its representatives are quite unwilling to put any final limit to the demand which may be made upon the waters of Lake Michigan for its sanitation under the system now in use. I have before me the report of 1911 of the president of the sanitary district in which he says:

" 'I am of the opinion that the presumption that our water supply is to be limited to 10,000 cubic feet per second, or 600,000 cubic feet per minute, is gratuitous and mischievous and should not be voiced by the officials of this district. I believe that we should have the volume requisite to our needs as they appear and are justified.'

"It is therefore quite conceivable that compliance with their sanitary needs according to this method of sanitation may eventually materially change this great natural

watercourse now existing through the Lakes. The weighing of the sanitation and possibly the health of one locality over against the commerce of the rest of the Nation and the consideration of our relations and obligations to Canada in respect to a great international waterway are not matters of mere technical or scientific deduction. They are broad questions of national policy. They are quite different in character, for example, from the question of fixing the proper location of a pierhead line or the height or width of a drawbridge over a navigable stream—fair samples of the class of questions which come to the Secretary of War for decision under the above mentioned act of 1899. While the researches and opinions of experts in the respective fields are necessary and useful as an assistance toward reaching a fair and proper policy, the final determination of that policy should belong not to an administrative officer but rather to those bodies to whom we are accustomed to entrust the making of our laws and treaties.

"In my view of the proper exercise of my discretion in this matter the foregoing considerations are sufficient for a decision of this case. Having reached the conclusion that the proposed diversion of the waters of Lake Michigan would substantially injure the interests of navigation on the Great Lakes which it is my legal duty to protect, it would clearly follow that the present application should be denied.

"I have carefully examined, however, the evidence which both sides have introduced bearing upon the sanitary needs of the City of Chicago, and my conclusion is in no way shaken. I am not persuaded that the amount of water applied for is necessary to a proper sanitation of the City of Chicago. The evidence indicates that at bottom the issue comes down to a question of cost. Other adequate systems of sewage disposal are possible and are in use throughout the world. The problem that confronts Chicago is not different in kind but simply larger and more pressing than that which confronts all of the other cities on the Great Lakes, in which nearly 3,000,000 people of this country are living. The urban

population of those cities, like that of Chicago, is rapidly increasing, and a method of disposition of their sewage which will not injure the potable character of the water of the Lakes must sooner or later be found for them all. The evidence before me satisfies me that it would be possible in one of several ways to at least so purify the sewage of Chicago as to require very much less water for its dilution than is now required by it in its unpurified condition. A recent report of the engineer of the sanitary commission (Oct. 12, 1911) proposes eventually to use some other method, but proposes to postpone its installation for a number of years to come, relying upon the present more wasteful method in the meanwhile. It is manifest that so long as the City is permitted to increase the amount of water which it may take from the Lakes, there will be a very strong temptation placed upon it to postpone a more scientific and possibly more expensive method of disposing of its sewage. This is particularly true in view of the fact that by so doing it may still further diminish its expenses by utilizing the water diverted from the Lakes for water power at Lockport. But it must be remembered that for every unit of horsepower realized by this water at Lockport four units of similar horsepower would be produced at Niagara, where the natural conditions are so much more favorable. Without, therefore, going more into detail in a discussion of this question, I feel clear that no such case of necessity has been presented by the evidence before me as would justify the proposed injury to the many varied interests in the great waterways of our Lakes and their appurtenant rivers.

"It remains only to consider certain special arguments that have been pressed upon me. It has been urged that the levels of the lakes, even if lowered, could be restored by compensating works. To a certain extent that is true. But the very nature of this consideration offers another illustration of the importance of having the whole question passed upon by Congress. Such compensating works can only be constructed by the authority of Congress and at very considerable cost. It is not a matter which is in the hands of the Secretary of War. Permission to di-

vert water which will at one and the same time nullify the effect of past appropriations and make necessary similar expenditures in the future, should be granted only with the express consent of the body in whose hands the making of such appropriations and the authorization of such works rest.

"Furthermore, in most cases such compensating works could only be constructed with the joint consent of our neighbor Canada. The United States Government alone would be unable, even if it were willing to spend its own funds, to compensate for the damage done through the lowering of these levels, unless Canada were willing to join in constructing the portion of such works which would necessarily stand upon Canadian soil.

"The question therefore becomes not merely national but international, and this leads me to the consideration of the arguments which were urged by both sides in reference to the treaty with Great Britain in respect to Canada of January 11, 1909. A careful consideration of that treaty fails to indicate to me that it is in any way controlling upon the question now before me. It gives to the citizens of both countries certain mutual rights of navigation in the waters of the Great Lakes and their connecting rivers; but beyond that the question of the right of this diversion at Chicago seems to me to have been carefully excluded. The applicants for the permit have urged upon me that article 8 of the treaty gives a preference to the uses of water of the lakes for domestic and sanitary purposes over the uses of such water for navigation. Article 8, however, applies only to future cases brought before the International Joint Commission; and furthermore I am clearly of the opinion that the domestic and sanitary purposes referred to in that article were intended to be the "ordinary" uses of such waters for domestic and sanitary purposes referred to in article 3. It would be quite contrary to our own national policy to give such a preference to an extraordinary sanitary use of such a character as to create a substantial injury to navigation. The matter has been before our own Supreme Court in the case of *the United States vs. The Rio Grande Dam &*

Irrigation Co. (174 U. S. 690). In that case the Supreme Court held that a company which proposed to take the water of the Rio Grande river for the purpose, among others, "of supplying water to cities and town for domestic and municipal purposes" could be prevented from so doing when the result would be a substantial injury to the navigability of the Rio Grande river farther down. In its opinion the court said:

" 'The question always is one of fact, whether such appropriation substantially interferes with the navigable capacity within the limits where navigation is a recognized fact. In the course of the argument, this suggestion was made, and it seems to us not unworthy of note, as illustrating this thought. The Hudson river runs within the limits of the State of New York. It is a navigable stream and a part of the navigable waters of the United States, so far at least as from Albany southward. One of the streams which flows into it and contributes to the volume of its waters is the Croton river, a non-navigable stream. Its waters are taken by the State of New York for domestic uses in the City of New York. Unquestionably the State of New York has a right to appropriate its waters, and the United States may not question such appropriation, unless thereby the navigability of the Hudson be disturbed. On the other hand, if the State of New York should, even at a place above the limits of navigability, by appropriation for any domestic purposes, diminish the volume of waters, which, flowing into the Hudson, make it a navigable stream, to such an extent as to destroy its navigability, undoubtedly the jurisdiction of the National Government would arise and its power to restrain such appropriation be unquestioned; and within the purview of this section (act of Sept. 19, 1890, ch. 907) it would become the right of the Attorney General to institute proceedings to restrain such appropriation.'

"The treaty, however, contains provisions in its article 10 by which "any question or matters of difference arising between the high contracting parties involving the rights, obligations, or interests of the United States or of the Dominion of Canada, either in relation to each

other or to their respective inhabitants, may be referred for decision" to an international joint commission established by the said treaty. The hearing before me brought forth the fact that the Government of Canada regards the proposal contained in this application as one which affects the material interests of that country. The establishment by formal treaty between the two countries of a tribunal with jurisdiction to decide just such questions seems to me to afford an additional reason against the assumption of jurisdiction to decide the question by an administrative officer of one of those countries.

"In short, after a careful consideration of all the facts presented, I have reached the following conclusions:

"First. That the diversion of 10,000 cubic feet per second from Lake Michigan, as applied for in this petition, would substantially interfere with the navigable capacity of the navigable waters in the Great Lakes and their connecting rivers.

"Second. That that being so, it would not be appropriate for me, without express congressional sanction, to permit such a diversion, however clearly demanded by the local interests of the sanitation of Chicago.

"Third. That on the facts here presented no such case of local permanent necessity is made evident.

"Fourth. That the provisions of the Canadian treaty for a settlement by joint commission of "questions or matters of difference" between the United States and Canada offer a further reason why no administrative officer should authorize a further diversion of water, manifestly so injurious to Canada, against Canadian protest.

"The prayer of the petition is therefore denied.

HENRY L. STIMSON,

Secretary of War."

Doc. 41, Ex. 12, Tr. 390-409.

Opinion of Secretary of War Stimson denying Application of the Sanitary District of Chicago.

On March 23, 1908, the Attorney General of the United States caused to be filed in the United States Circuit Court, Northern District of Illinois, Eastern Division, a bill of complaint, No. 29-19, seeking to enjoin the Sanitary District of Chicago from constructing the Calumet Sag Canal, diverting through it the waters of the Calumet River or Lake Michigan and reversing the current in the Calumet River.

It was alleged by the Government that these acts would lessen, impede, and obstruct navigation in the navigable Calumet River, and would lower the level of Lake Michigan and thus decrease its navigability, and therefore were unlawful under section 10 of the river and harbor act of March 3, 1899, because they had neither been authorized by Congress nor recommended by the Chief of Engineers, United States Army, and approved by the Secretary of War.

The respondent answered, denying or belittling each allegation, denying that the Calumet River was navigable within the meaning of the terms, or that diverting water from Lake Michigan would lower its level, or that the act of March 3, 1899, was applicable or even a constitutional or valid enactment.

At the same time the respondent claimed the project would benefit navigation; that State law required it to carry out the project; that it was the only authorized agency for providing the needed drainage and sewerage, and the proposed method was the only lawful one under state enactment; that it made application to the Secretary of War for a permit only as to mere matter of comity; and that the old Illinois and Michigan canal laws constituted authorization by Congress. This answer was filed March 23, 1908.

Evidence of the complaint was taken from February 15, 1909, to July 8, 1909. The defendant proceeded to again open negotiations with the War Department and did not for a time make testimony on its own behalf.

The Government testimony was directed to the questions of the effect of the diversion upon the navigable capacity of the lakes and their connecting waters, and the resulting injury to the interests of navigation. When, finally, on May 31, and June 1, 1911, the defendant took testimony, it was not directed toward meeting the testimony of the Government witnesses, but rather to establishing the desirability of the project from a sanitary standpoint and to showing that while there were other efficient methods for the disposal of the sewage of the Calumet district the proposed dilution method was the cheapest. Thereupon the case rested while the defendant again negotiated with the Secretary of War. On March 18, 1913, the defendant renewed taking its evidence.

On October 6, 1913, because of the refusal of the defendant to comply with the terms of the permit of the Secretary of War respecting the diversion through the Chicago River, the Attorney General caused another bill, equity No. 114, to be filed in the same court, praying that the defendant be enjoined from diverting more than 4,167 cubic feet of water per second from Lake Michigan through the Chicago River.

The two suits were consolidated and heard as one, and the taking of evidence, begun on March 18, 1913, was continued until its final completion on December 19, 1914. Altogether, a large number of expert witnesses was called on each side. The arguments of counsel on the law and facts were presented in 1915.

On June 19, 1920, Federal Judge Landis rendered an oral opinion in the case, which was in effect a finding that the United States was entitled to an injunction restraining the Sanitary District from diverting more than 4,167 cubic feet of water per second from Lake Michigan.

Very shortly after this oral opinion was rendered the defendant filed a motion for its reconsideration, July 10, 1920. The court heard the motion on July 12, 1920, and asked both parties to submit authorities.

Federal Judge Landis resigned his position in March, 1922. Upon representation of the United States attorney

the case was transferred to Judge Carpenter, who asked that the complainant submit a brief covering the points brought out by the defendant's motion on July 10, 1920. Briefs were submitted, counter proposals offered and rebutted, and after several hearings before the Federal Judge a formal decree was entered on June 18, 1923, finding against the Sanitary District of Chicago and in favor of the Federal Government. (See Appendix X). The court granted a stay of execution of six months for the purpose of allowing the defendants ample time to seek relief from the Supreme Court of the United States or from Congress. The Sanitary District filed an appeal on June 20, 1923.

As a result of its disregard of Federal jurisdiction the sanitary district has rendered null and void the permits issued for the construction of the Calumet Sag Channel and the construction and operation of the North Shore Channel.

Both permits contained the condition that the total diversion of water from Lake Michigan into the Illinois River, should be no greater than already authorized by past War Department permits. As the amount withdrawn has exceeded the amount thus authorized, the permits are null and void, and the structures are illegal.

On November 9, 1921, a resolution was introduced in the House of Representatives, being entitled "A bill to limit the amount of water which may be withdrawn from Lake Michigan by the Sanitary District of Chicago, giving authority therefor, and fixing conditions of such withdrawal."

This resolution obviously was drawn up by or for the sanitary district, the object being to obtain congressional authorization for a diversion of 10,000 cubic feet per second. The Secretary of War, upon being consulted by the Committee on Rivers and Harbors, advised against the passage of the enactment in a letter of February 2, 1922.

His recommendations are set forth clearly in the following extract from the letter referred to:

"It is clear that under the conditions of affairs created by the Chicago Sanitary District, the diversion of a certain quantity of water is necessary at present for the proper protection of the health of the citizens of Chicago.

"It is by no means established, however, that the quantity required for that purpose, either now or in the future, is 10,000 cubic feet per second. I regard it as inadvisable to permit the diversions in that amount or in any amount exceeding the amount now fixed by the department without full and complete information concerning the necessity therefor. It is my view that the quantity authorized should be limited to the lowest possible for sanitation after the sewage has been purified to the utmost extent practicable before its discharge into the sanitary canal. I regard it as extremely inadvisable to grant the city of Chicago, or any other agency, the right in perpetuity to take from the lake a definite quantity of water. It is not improbable that within a generation a method may be found to separate the valuable fertilizing elements from sewage as a consequence of which the withdrawal of water from the lake to dilute the sewage will no longer be necessary.

In view of the substantial widespread damage done to many activities throughout the United States by the diversion, damage which can be but partly compensated for by the construction of the works proposed in the bill, the diversion should not be continued beyond the time when its necessity ceased to exist."

A Bill was presented to Congress on January 27, 1923, shortly before the closing of its last session, modifying the terms of the House resolution of November 9, 1921, and including provisions for a 9-foot waterway from Utica to Cairo, Ill., by way of the Illinois and Mississippi Rivers.

These provisions serve to make the measure more attractive to residents of towns along the Illinois River, but do not alter the primary object of the legislation—that of obtaining congressional authority for a diversion of 10,000 cubic feet per second. This bill is to be reported on by a special committee of the Senate at the next session of Congress.

Putnam Report, Ex. 1-G, Tr. 410-416.

"THE SANITARY DISTRICT OF CHICAGO
910 So. Michigan Avenue,

January 31, 1925.

Sir:

The Sanitary District of Chicago hereby applies for permission to divert an annual average of ten thousand cubic second feet of water from Lake Michigan through the channels of the Sanitary District of Chicago, for the purpose of preserving the lives and health of all of its people, and of the millions of others in constant, daily contact with them.

We have prepared a brief statement of facts in support of this application, which we present herewith for your consideration, all of which is respectfully submitted.

Yours very truly,

SANITARY DISTRICT OF CHICAGO,
By LAURENCE V. KING,
President.

ALEX N. TODD,
JOHN K. LAWLER,
MORRIS ELLER,
AUGUST W. MILLER,
T. J. CROWE,
JAMES M. WHALEN,
FRANK J. LINK,
MICHAEL ROSENBERG,
Trustees.

EDWARD J. KELLY,
Chief Engineer.

Attest:
HARRY E. WALLACE,
Clerk.

Doc. 42, Ex. 12, Tr. 417-418.

Application of Sanitary District for Permit of March 3, 1925.

21st Ind.

U. S. Engineering Office, Chicago, Ill., March 2, 1925.

To the Chief of Engineers, Washington, D. C.

1. This is an application from the Sanitary District of Chicago, a municipality created under the laws of the State of Illinois, to divert 10,000 cubic feet per second of water from Lake Michigan, for the purpose of keeping the sewage of that locality from contaminating its water supply and for reducing the sewage by dilution.

2. This question of the diversion of water from Lake Michigan has been so thoroughly investigated by the Department and discussed at such great length in various reports that it is not believed advisable to enter into any description or historical review before presenting the recommendations which are to follow. Detailed information of this character may be found in the report entitled "Diversion of Water from Lake Michigan," which was submitted by this office on November 1, 1923.

3. This application is prompted by the action of the United States Supreme Court on January 5, 1925, by which it sustained the position taken by the local United States Court, requiring adherence to the limitations placed by the Secretary of War on the amount of the diversion. The local authorities are faced with the alternative of a reduction in the amount of diversion to 4,167 cubic feet per second by March 5, 1925, or relief from Congress or the War Department.

4. In the issuance of a permit, the exact meaning of the word "diversion" should be understood. In the recommendations which follow, by diversion is meant the amount of water which is actually withdrawn from Lake Michigan by the Sanitary District of Chicago through its main drainage canal and auxiliary channels, and is not inclusive of the amount flowing in the channels which come from the sewers of the locality. In other words, "diversion" is taken to be the gross flow at Lockport, less the amount of water used by the city of Chicago for domestic purposes.

5. It is recommended that a permit be issued to the Sanitary District of Chicago, covering a period of five

years, to divert from Lake Michigan through its main drainage canal and auxiliary channels, an amount of water not to exceed an annual average of 8,500 cubic feet per second; the instantaneous maximum not to exceed 1,000 cubic feet per second. This permit should be made conditional upon the following:

(1) The Sanitary District of Chicago shall carry out a program of sewage treatment by artificial processes which will provide the equivalent of the complete (100%) treatment of the sewage of a human population of at least 1,200,000 before the expiration of the permit.

(2) The Sanitary District shall pay its share of the cost of regulating or compensating works to restore the levels or compensate for the lowering of the Great Lakes system, if and when constructed, and post a guarantee in the way of a bond or certified check in the amount of $1,000,000 as an evidence of its good faith in this matter.

(3) The Sanitary District shall submit for the approval of the Chief of Engineers and the Secretary of War plans for controlling works to prevent the discharge of the Chicago River into Lake Michigan in times of heavy storms. These works shall be constructed in accordance with the approved plans and shall be completed and ready for operation by July 1, 1929.

(4) The execution of the sewage treatment program and the diversion of water from Lake Michigan shall be under the supervision of the U. S. District Engineer at Chicago, and the diversion of water from Lake Michigan shall be under his direct control in times of flood on the Illinois and Des Plaines Rivers.

(5) If, within six months after the issuance of this permit, the city of Chicago does not adopt a program for metering at least ninety per cent of its water service and provide for the execution of said program at the average rate of ten per cent per annum thereafter, this permit may be revoked without notice.

(6) The average diversion from Lake Michigan during 1924 by the Sanitary District has been approximately 8,500 cubic feet per second. This diversion, combined with

the discharge from the sewers of the locality, produced a total flow at Lockport of about 9,700 cubic feet per second. This so closely approximates the flow necessary to safeguard against reversals of the river into the Lake in times of storm (10,000 cubic feet per second) that a permit for diversion of 8,500 cubic feet per second will suffice in this regard. * * * No obligation appears to rest with the Department to prevent any increase in pollution of the Illinois and Des Plaines Rivers; the maintenance of status quo as regards amount of diversion will place the burden of relieving the lower river situation upon the Sanitary District. Until the controlling works (Condition 3) are completed, ample protection against the dangers of a reversal of the river is provided by the authority to divert an instantaneous maximum of 11,000 cubic feet per second.

(7) Condition (1) as proposed provides for the execution of a sewage treatment program which will relieve the load on the Drainage Canal by the equivalent of a population of 1,200,000. * * * Compliance with this condition will make possible a reduction in amount of diversion to 7,250 cubic feet per second, or lower, by the end of 1929. This condition looks to a reduction to 4,167 cubic feet per second by 1935.

* * * * *

12. Condition (3) is considered necessary to permit an ultimate reduction of the diversion to 4,167 cubic feet per second. Controlling works of some sort will be required to keep the Chicago River from discharging into Lake Michigan in times of flood, and at least two types have been suggested which are believed to be practical.

13. The provision with reference to metering of the water service of the city of Chicago is included for three reasons:

(a) There will be a substantial saving in the cost of construction and operation of sewage treatment plants due to the decreased amount of sewage to be treated.

(b) There will be a substantial reduction in the amount of lake water used for domestic purposes.

(c) It will be possible for the city of Chicago to finance a filtration system for its water supply when its water consumption is reduced to a reasonable amount. When the water supply is filtered, the dangers incident to an occasional reversal of the Chicago River will be entirely eliminated.

14. A shorter time limit for the permit is not recommended as results produced by the end of 1927, for instance, will not permit a reduction in the amount of the diversion, which it is believed should be required in any renewal, no matter when it is made. Furthermore, sufficient performance can not be prescribed for a shorter period to insure completion of a larger program looking to a reduction in diversion to 4,167 cubic feet per second by 1935.

RUFUS W. PUTNAM,
Major, Corps of Engineers,
District Engineer.

Doc. 43, Ex. 12, Tr. 418-423, 427-428.

Recommendation of U. S. District Engineer upon Application of Sanitary District for Permit of March 3, 1925.

7510 (Sanitary Chicago)

Subject: Permission to divert water from Lake Michigan.

2nd Ind.

Office C. of E., March 3, 1925.

TO THE SECRETARY OF WAR.

1. The Sanitary District of Chicago has made application for a permit to divert an annual average of 10,000 cubic feet per second from Lake Michigan through the channels of the Sanitary District.

2. The District Engineer recommends the issuance of a permit, covering a period of five years, to divert through the main drainage canal and auxiliary canals of the Sanitary District, an amount of water not to exceed an annual

average of 8,500 cubic feet per second; the instantaneous maximum not to exceed 11,000 cubic feet per second, such permit to be subject to certain conditions set forth in the 1st indorsement hereon.

3. The first condition recommended by the District Engineer provides for the adoption and execution of a program of construction of modern sewage disposal plants at such a rate as to provide before the end of five years for treatment of the sewage of a human population of 1,200,000. This figure is believed to be the maximum practicable under existing conditions, and the proposed construction is the first step in a program which will permit the ultimate reduction of the amount of water diverted, to 4,167 cubic feet per second, or lower, as treatment plants are installed.

4. The program of construction recommended is limited to five years, as it is not possible to predict what advances may be made in the science of sewage disposal during the next five years. It is entirely within the realms of possibility that during that period such advances may be made as to warrant the Department's insisting on an even more rapid rate of progress thereafter, should a renewal of this permit be sought. A shorter period for the permit is not believed advisable as it would be difficult to prescribe sufficient progress in the way of construction of sewage treatment plants and require a substantial reduction in the diversion upon the renewal of the permit.

5. It is estimated that the construction of sewage treatment plants for a population of 1,200,000 will permit a reduction in the necessary diversion from Lake Michigan of about 1,250 cubic feet per second. In other words, such construction would permit a reduction in the authorized diversion, by December 31, 1929, to about 7,250 cubic feet per second. As stated above (paragraph 4), it is probable that a still more rapid rate of reduction of diversion may be practicable thereafter.

6. It is, of course, highly desirable that the excessive diversion of water from Lake Michigan be reduced to reasonable limits with the utmost dispatch. For human-

itarian reasons, it is impracticable to make the desired reduction instantaneously, and it is believed that the procedure proposed by the District Engineer is the most reasonable and just to all concerned that can be adopted.

7. As further means of relieving the present undesirable situation with respect to lake levels, the District Engineer recommends as conditions of the permit the prompt adoption and execution of a program for metering Chicago's water supply, the construction of controlling works to prevent the discharge of the Chicago River into Lake Michigan in times of heavy storms, and also that the Sanitary District be required to pay a share of the cost of such regulating or compensating works for restoring Lake levels as may be constructed, posting a bond of $1,000,000 as a guarantee of their good faith in the matter.

8. I concur in the views of the District Engineer, and recommend the issuance of a permit in accordance with the draft herewith.

H. TAYLOR,

Major General, Chief of Engineers.

Doc. 44, Ex. 12, Tr. 429-431.

Recommendation of Chief of Engineers upon application of Sanitary District for Permit of March 3, 1925.

WAR DEPARTMENT.

Note. It is to be understood that this instrument does not give any property rights either in real estate or material, or any exclusive privileges; and that it does not authorize any injury to private property or invasion of private rights, or any infringement of Federal, State, or local laws or regulations, nor does it obviate the necessity of obtaining State assent to the work authorized. It merely expresses the assent of the Federal Government so far as concerns the public rights of navigation. (See *Cummings vs. Chicago,* 188 U. S., 410.)

PERMIT.

Whereas, by Section 10 of an act of Congress approved March 3, 1899, entitled "an act making appropriations for the construction, repair and preservation of certain public works on rivers and harbors, and for other purposes, it is provided that it shall not be lawful to build or commence the building of any wharf, pier, dolphin, boom, weir, breakwater, bulkhead, jetty, or other structures in any port, roadstead, haven, harbor, canal, navigable river, or other water of the United States, outside established harbor lines, or where no harbor lines have been established, except on plans recommended by the Chief of Engineers and authorized by the Secretary of War; and it shall not be lawful to excavate or fill, or in any manner to alter or modify the course, location, condition or capacity of any port, roadstead, haven, harbor, canal, lake, harbor of refuge, or inclosure within the limits of any breakwater, or of the channel of any navigable water of the United States, unless the work has been recommended by the Chief of Engineers and authorized by the Secretary of War prior to beginning the same;

And, Whereas, application has been made to the Secretary of War by the Sanitary District of Chicago, Illinois, for authority to divert an annual average of 10,000 cubic feet of water per second from Lake Michigan through the channels of said Sanitary District;

And, Whereas, in the judgment of the Secretary of War, an annual average diversion of more than 8,500 cubic feet per second should not now be permitted;

Now, therefore, This is to certify that, upon the recommendation of the Chief of Engineers, the Secretary of War, under the provisions of the aforesaid statute, hereby authorizes the said Sanitary District of Chicago to divert from Lake Michigan, through its main drainage canal and auxiliary channels, an amount of water not to exceed an annual average of 8,500 cubic feet per second, the instantaneous maximum not to exceed 11,000 cubic feet per second, upon the following conditions:

1. That there shall be no unreasonable interference with navigation by the work herein authorized.

2. That if inspections or any other operation by the United States are necessary in the interests of navigations, all expenses connected therewith shall be borne by the permittee.

3. That no attempt shall be made by the permittee or the owner to forbid the full and free use by the public of any navigable waters of the United States.

4. That the Sanitary District of Chicago shall carry out a program of sewage treatment by artificial processes which will provide the equivalent of the complete (100%) treatment of the sewage of a human population of at least 1,200,000 before the expiration of the permit.

5. That the Sanitary District shall pay its share of the regulating or compensating works to restore the levels to compensate for the lowering of the Great Lakes system if and when constructed, and post a guarantee in the way of a bond or certified check in the amount of $1,000,000 as an evidence of its good faith in this matter.

6. That the Sanitary District shall submit for the approval of the Chief of Engineers and the Secretary of War plans for controlling works to prevent the discharge of the Chicago River into Lake Michigan in times of heavy storms. These works shall be constructed in accordance with the approved plans and shall be completed and ready for operation by July 1, 1929.

7. That the execution of the sewage treatment program and the diversion of water from Lake Michigan shall be under the supervision of the U. S. District Engineer at Chicago, and the diversion of water from Lake Michigan shall be under his direct control in times of flood on the Illinois and Des Plaines Rivers.

8. That if, within six months after the issuance of this permit, the City of Chicago does not adopt a program for metering at least ninety per cent of its water service and provide for the execution of said program at the average rate of ten per cent per annum thereafter, this permit may be revoked without notice.

9. That if, in the judgment of the Chief of Engineers and the Secretary of War, sufficient progress has not been

made by the end of each calendar year in the program of sewage treatment prescribed herein so as to insure full compliance with the provisions of condition 4, this permit may be revoked without notice.

10. That this permit is revocable at the will of the Secretaary of War, and is subject to such action as may be taken by Congress.

11. That this permit, if not previously revoked or specifically extended, shall cease and be null and void on December 31, 1929.

Witness my hand this 3rd day of March, 1925.

H. Taylor,
Major General, Chief of Engineers.

Witness my hand this 3rd day of March, 1925.

John W. Weeks,
Secretary of War.

Doc. 45, Ex. 12, Tr. 432-435.

Permit of March 3, 1925.

WAR DEPARTMENT
WASHINGTON.

March 3, 1925.

Mr. Lawrence F. King,
President, Board of Trustees,
Sanitary District of Chicago,
910 South Michigan Avenue,
Chicago, Illinois.

Dear Sir:

With reference to your application of January 31, 1925, for permission to divert an annual average of ten thousand cubic feet of water per second from Lake Michigan through the channels of the Sanitary District of Chicago, it is my pleasure to inform you that after careful consideration by the Chief of Engineers and myself, and acting upon his recommendation, I have issued a permit, effective this date,

authorizing the temporary withdrawal of 8,500 cubic feet of water per second until December 31, 1929. One copy of this permit is transmitted herewith.

Your attention is invited to the conditions to which this authorization is subject, particularly those prescribing certain definite accomplishments on the part of your locality. This Department has always held and continues to hold that the taking of an excessive amount of water for sanitation at Chicago does affect navigation on the Great Lakes adversely, and that this diversion of water from Lake Michigan should be reduced to reasonable limits with utmost dispatch. I appreciate that the desired reduction can not be made instantaneously, but with the view of making a substantial reduction by the time this permit expires, the conditions require, among other things, the artificial treatment of the sewage of a large population, the construction of controlling works to prevent the discharge of the Chicago river into the lake, and the metering of the water service of the City of Chicago.

I am not emphasizing too strongly the importance of diligent and prompt execution of the conditions imposed. If it is necessary to increase the bonding power of the Sanitary District from three to five per cent of the assessed valuation of the taxable property, or if increased taxing power is imperative, the requisite legislative permission should be obtained promptly. While it is not in my province to dictate, I sincerely urge the reduction of your expenses to the lowest possible requirements, and, further, that arrangements be made with the packers and the Corn Products interests to treat their waste before discharging it into the sewers.

I believe that steps should be taken which will enable Chicago to complete the entire work within ten years.

Sincerely yours,

JOHN W. WEEKS, (Sgd.)
Secretary of War.

Doc. 46, Ex. 12, Tr. 436-437

Letter of Secretary of War transmitting Permit of March 3, 1925.

June 25, 1925.

Mr. Henry G. Chilton, C. M. G.,
Envoy Extraordinary and Minister Plenipotentiary,
Charge d'Affaires adinterim of Great Britain.

Sir:

Referring further to your note No. 467 of May 7, 1925, concerning the diversion of water from Lake Michigan by the Sanitary District of Chicago, I have the honor to furnish you with the following information in reply to the inquiries made by the Canadian Government:

First: The actual average flow of the water passing Lockport during the year ending March 3, 1925, has been 9,700 cubic feet per second.

Second: This average flow of water passing Lockport will not be immediately reduced by an amount under the terms of the permit issued by the Secretary of War on March 3, 1925.

Third: This average flow may be reduced by December 31, 1929, by an amount varying from 1,750 to 3,000 cubic feet per second.

By way of explanation of the wide range over which the amount of reduction by December 31, 1929, varies, it should be stated that the amount of reduction depends upon the decrease in the sewage load on the water in the drainage canal. The permit prescribes that a minimum population of 1,200,000 be provided with the equivalent of 100% treatment. The program of sewage treatment plant construction contemplates the completion of plants which will give 100% treatment to a population of slightly over 1,400,000. If this program is carried to completion a larger reduction may be made in the flow than if only the requirements of the permit are carried out.

Furthermore, when the controlling works which are required to be placed in the Chicago River or Drainage Canal to prevent reversals into Lake Michigan in times of flood are completed and in operation it may be found practicable to make a much larger reduction in the flow of water

with safety to the water supply of the City of Chicago during winter season, a time when the oxygen content of the diluting water is much higher than it is during the summer season.

It is also expected that there will be a substantial reduction in the amount of water consumed in the locality for domestic purposes as the result of a requirement of the permit of March 3, 1925, which makes it necessary for the city of Chicago to adopt and carry into execution a program of metering its water supply. By December 31, 1929, this reduction will vary between 400 and 600 cubic feet per second.

The net result of all these varying influences will be to make it possible to reduce the average flow by a minimum amount of 1,750 cubic feet per second and possibly by the maximum amount of 3,000 cubic feet per second.

To explain the apparent inconsistency between the amount of water specified in the permit (8,500 cubic feet per second measure at the intakes) and the flow at Lockport (9,700 cubic feet per second) it might be stated that the difference represents the amount of domestic water consumption by the city of Chicago which would not be authorized or included properly in a permit issued to the Sanitary District of Chicago, a separate municipality, other than to make the permit non-operative in case of failure on the part of the former agency to adopt certain measures of conservation which were specified. Condition 8 of the permit of March 3, 1925, looks to a substantial reduction of this portion of the flow in the Chicago Drainage Canal, at the same time condition 4 makes possible a reduction in the amount of water used for dilution of sewage.

Accept, Sir, the renewed assurances of my high consideration.

For the Secretary of State:

JOSEPH C. GREW.

Ex. 17, Tr. 438-440.

November 24, 1925.

His Excellency,

The Right Honorable,

Sir Esme Howard, G. C. M. G., K. C. B. C. V.,
Ambassador of Great Britain.

Excellency:

Referring further to your Embassy's note No. 813 of September 15, 1925, bringing to my attention certain remarks and inquiries of the Canadian Government in regard to the diversion of water from Lake Michigan by the Sanitary District of Chicago, I take pleasure in submitting the following statements:

The Sanitary District of Chicago to which the permit of March 3, 1925, was issued by the Secretary of War, is a municipal corporation separate and distinct from the City of Chicago. The operations of the Sanitary District are conducted under direct authority of the legislature of the State of Illinois without reference to the operations of the municipal government of the City of Chicago. Diversion of water for domestic consumption in the City of Chicago being purely a function of the municipal government of the city, it is considered that the authority granted the Sanitary District could not be made to apply to or include this other diversion as well. The case before the Secretary of War for action involved the granting of a permit for diversion of water for sanitary purposes only, and the instrument of authority was worded accordingly.

On the other hand, it seemed to the Secretary of War that the diversion of water for domestic consumption by the City of Chicago was larger than it should be, and that the amount wasted was not a negligible portion of the gross diversion. He also considered that this excessive diversion for domestic purposes made the cost of sewage treatment, plant construction and operation unnecessarily high and consequently added to the length of the construction period and the difficulties of financing. For these reasons the Secretary of War took cognizance of the diversion for which the City of Chicago is responsble, in a restrictive way, rather than by permissive means, and in-

cluded a condition in the permit making the instrument voidable in case the City of Chicago fails to take specified steps looking to a curtailment in the amount of water diverted for domestic purposes.

In the judgment of the Secretary of War the average diversion which should be authorized for sanitary purposes under the conditions known to exist should be not less than 8,500 cubic feet per second. The safety of the lives and health of citizens of the locality cannot be disregarded, and until the conditions of the permit of March 3, 1925, have been complied with no substantial reduction in the amount of diversion could be made without endangering health if not life.

The expression "measured at the intakes" used to designate the places where the total actual flow should not exceed that specified in the permit, is hypothetical as it is impracticable to measure the diversion at the numerous intakes with accuracy. For this reason, the practical enforcement of the limitation placed upon the diversion will be carried out at Lockport. Measurements taken there will determine the gross diversion, sanitary and domestic, and, as accurate information is available in regard to the amount of water pumped by the City of Chicago for domestic purposes, the sanitary diversion may be computed by subtracting the domestic diversion from the gross flow at Lockport.

* * * * *

The Canadian Government is correct in concluding that no immediate reduction in diversions has been provided, but its conclusion that no definite reduction is assured and that the effect of the permits will actually be to authorize a greater diversion than is now being made cannot be confirmed. The gross flow at Lockport will not exceed an average of 9,700 cubic feet per second, and by the time the permit of March 3, 1925, has expired the gross flow may be reduced to 8,000 cubic feet per second and probably to 6,700 cubic feet per second. The sewage treatment program of the Sanitary District has been arranged, so as to make it possible to effect a reduction to a gross flow of 4,167 cubic feet per second by the year 1935 or before.

I shall be grateful if you will cause the foregoing statements to be brought to the attention of the Canadian Government.

Accept, Excellency, the renewed assurances of my highest consideration.

(Signed) FRANK B. KELLOGG.

Ex. 17, Tr. 441-443.

Diplomatic Correspondence between the United States and Canada.

FOURTH. The Action of Congress.

If it be assumed that Congress has power to control the diversion, to determine whether and to what extent it should be permitted, the next question is whether it has exercised the power, and, first, whether it has exercised it directly.

It is believed that enough has been set forth in the findings (*supra*, pp. 26-72, 85) to show the grounds for the contention of the defendants with respect to the action of Congress. The defendants refer to the Acts of 1822 and 1827 (*supra*, p. 11) in relation to the Illinois and Michigan Canal. They emphasize the fact that the project of a waterway from Lake Michigan to the Mississippi has from an early date engaged the attention of Congress, and that it has asked for and received many reports upon that subject. Congress was also early and fully advised by official reports as to the action of Illinois in providing for the construction of a drainage canal, its actual construction by the Sanitary District, the plan to divert water from Lake Michigan for the purposes of the canal, and the extent of the diversion contemplated. In these reports, the relation of the drainage canal proposals to a Lakes-to-the-Gulf waterway was clearly shown. As early as 1900 Congress directed (*supra*, p. 41) that the Board of Engineers appointed under the Act of March 3, 1899, report the estimates of cost for channels of specified depth through the proposed route from the Illinois River to Lake Michigan and directed that "the said estimates cover and in-

clude a proper connection at Lockport with the sanitary and ship canal which has been constructed by the sanitary district of Chicago." Defendants have stressed the point that at no time since the diversion at Chicago began could the project depth of seven feet in the Illinois River have been maintained without a diversion of at least 8,500 c.s.f. It is also urged that Congress by the improvements it sanctioned and directed affirmatively authorized and actively aided the construction of what is called the Chicago River segment of the Sanitary District's diversion works. Congress made appropriations for the widening and deepening of the Chicago River and for the development of a waterway from Lockport, the terminus of the drainage canal, to the mouth of the Illinois River. Attention is called to the provision of the Act of March 3, 1899 (*supra*, p. 36) for the improvement of the Chicago River directing a survey and estimate of cost for a channel twenty-one feet in depth for a portion of the river with a proviso that the work of lowering tunnels should be done or caused to be done by the City of Chicago without expense to the United States. This work, it is insisted, was for the purpose of converting the river into an integral part of the Sanitary District's engineering works for the diversion of water from Lake Michigan. In *West Chicago Street Railroad Company vs. Chicago*, 201 U. S. 506, the proviso above mentioned was held to be a sufficient authorization to the City of Chicago to require the lowering of a street railway tunnel. In short, the defendants contend that there has been full knowledge on the part of Congress of all relevant facts and that Congress, and officials acting under its authority and reporting to it, have continuously co-operated with the State of Illinois and the Sanitary District in the creation and maintenance of conditions appropriate to the diversion. Congress has also called for and received comprehensive reports on the extent and effect of the diversion of water from Lake Michigan and on the measures that may be practicable to compensate for the lowered level of the Great Lakes (*supra*, p. 125).

It has not been considered necessary to lengthen the findings so as to include all the statements in a multitude

of reports in evidence bearing on the question, as, assuming that Congress was fully informed, the question is not as to what was recommended, but as to the action taken by Congress in the light of its knowledge. I am unable to find that Congress, apart from the authority conferred upon the Secretary of War by Section 10 of the Act of March 3, 1899, and his action thereunder, which will be discussed later, has authorized the diversion in question. The Acts of 1822 and 1827 (*supra*, p. 11) relating to the Illinois and Michigan Canal were considered in *Sanitary District vs. United States*, 266 U. S. 405, 427, 428, and were found to contain nothing with regard to the amount of water to be withdrawn from the lake. In that connection, the Court said:

"The defendant in the first place refers to two acts of Congress: one of March 30, 1822, 3 Stat. 659, which became ineffectual because its conditions were not complied with, and another of March 2, 1827, c. 51, 4 Stat. 234, referred to, whether hastily or not, in *Missouri vs. Illinois*, 200 U. S. 496, 526, as an act in pursuance of which Illinois brought Chicago into the Mississippi watershed. The act granted land to Illinois in aid of a canal to be opened by the State for the purpose of uniting the waters of the Illinois River with those of Lake Michigan, but if it has any bearing on the present case it certainly vested no irrevocable discretion in the State with regard to the amount of water to be withdrawn from the Lake. It said nothing on that subject. We repeat that we assume that the United States desire to see the canal maintained and therefore pass by as immaterial all evidence of its having fostered the work. Even if it had approved the very size and shape of the channel by act of Congress it would not have compromised its right to control the amount of water to be drawn from Lake Michigan. It seems that a less amount than now passes through the canal would suffice for the connection which the United States has wished to establish and maintain."

Consideration by Congress of the advisability of the proposed waterway from Lake Michigan to the Illinois and Mississippi Rivers, demands by Congress for surveys,

plans and estimates, the establishment of project depths, and appropriations for specified purposes, did not in my opinion constitute direct authority for the diversion in question, however that diversion, or the diversion of some quantity of water from Lake Michigan, might fit into an ultimate plan. The appropriations for widening and deepening the Chicago River, and the cooperation with the Sanitary District for several years in that improvement, committed Congress to the work as thus actually prescribed or authorized, but did not go further, whatever the advantage of that work in connection with the purposes of the Sanitary District's Canal. The action which has been taken by Congress may, indeed, be deemed to have an important bearing on the construction of the act of Congress under which, as Congress well knew, the Secretary of War granted permits for the diversion of specified quantities of water from Lake Michigan. But the point now is as to direct authorization by Congress of the diversion as distinguished from action by the Secretary of War under the general authority Congress has conferred upon him.

The defendants invoke the doctrine of *Wisconsin v. Duluth*, 96 U. S. 379. There it was found that Congress had developed and was carrying out a system of corporate improvements at Duluth and had made appropriations for that purpose. The Court regarded the suit as an effort to have the Court forbid the execution of the work authorized and dismissed the bill. This decision may be regarded as applicable to the present case, if it be found that the Secretary of War's permit is valid and that the Federal Government under lawful authority has assumed charge of the diversion, its extent, and the conditions on which it is permitted. But the *Duluth* case is not considered to be an authority for a conclusion here that Congress has directly authorized the diversion apart from the action of the Secretary of War.

The argument that Congress, aside from the action of the Secretary of War, has authorized the diversion, at once raised the question—In what amount has the diversion been thus authorized? There is nothing in any of the acts

of Congress upon which the defendants rely specifying any particular quantity of water which could be diverted and it could hardly be considered a reasonable contention that the acts of Congress justified any diversion of water from Lake Michigan that the State of Illinois and the Sanitary District might see fit to make. It is manifest that it was the view of the War Department that Congress had not acted directly and whatever the Department did was subject to such action as Congress might take. In the report of the Board of Engineers required by the Act of June 13, 1902, transmitted to Congress on December 18, 1905, the Board said: "The taking of large quantities of water from Lake Michigan for drainage purposes has not been authorized by Congress. It has been the policy of the War Department thus far to regulate the quantity of water which is admitted to the canal by the necessities of navigation in the Chicago River" (*supra,* p. 44). This shows the understanding at that time. In 1907, in denying the application for an increase in the amount permitted to be diverted, the Secretary of War considered that it might "be fortunate that circumstances now require submission of this question of capital and national importance to the Congress of the United States" (*supra,* p. 51). This understanding that Congress had not yet acted directly so as to authorize the diversion in question has continued. It was in this view that the United States prosecuted its suit to decree in this Court to enjoin the defendants from taking more water from Lake Michigan than the Secretary of War had allowed."

Special Master's Report 171-175.

APPENDIX "S"

SANITARY DISTRICT OF CHICAGO

Tabulation of Flow in Sanitary and Ship Canal

Year	Total Flow at Lockport	Sewage Flow (Chicago Water Works Pumpage)	Water directly abstracted from Lake Michigan by Sanitary District
1900	2990 C.F.S.	449 C.F.S.	2541 C.F.S.
1901	4046 "	531 "	3515 "
1902	4302 "	554 "	3748 "
1903	4971 "	582 "	4389 "
1904	4793 "	618 "	4175 "
1900-04	4220 "	547 "	3673 "
1905	4480 "	636 "	3844 "
1906	4473 "	676 "	3797 "
1907	5116 "	704 "	4412 "
1908	6443 "	726 "	5717 "
1909	6495 "	744 "	5751 "
1905-09	5401 "	697 "	4707 "
1910	6833 "	803 "	6036 "
1911	6896 "	785 "	6111 "
1912	6938 "	853 "	6085 "
1913	7839 "	894 "	6945 "
1914	7815 "	949 "	6866 "
1910-14	7264 "	857 "	6407 "
1915	7738 "	939 "	6799 "
1916	8200 "	972 "	7228 "
1917	8726 "	993 "	7733 "
1918	8826 "	1018 "	7808 "
1919	8595 "	1106 "	7489 "
1915-19	8417 "	1006 "	7411 "
1920	8346 "	1176 "	7170 "
1921	8355 "	1199 "	7156 "
1922	8858 "	1216 "	7642 "
1923	8348 "	1220 "	7128 "
1924	9465 "	1274 "	8191 "
1920-24	8674 "	1217 "	7457 "
1925	8278 "	1338 "	6940 "
1926	8283 "	1395 "	6888 "

Exhibit 1111, Transcript 3361-3362,
Report of Special Master pp. 22-23.

The quantities of diversion from the Great Lakes watershed permitted from time to time under the various permits of the Secretaries of War are shown by the following quotations from the various permits as they were modified from time to time:

PERMIT OF JANUARY 17, 1903:

* * * * *

And whereas said Sanitary District of Chicago has applied for permission to increase the flow through the Chicago River from 250,000 cubic feet per minute to 350,000 cubic feet per minute during the closed season of navigation, in order to carry off the accumulation of sewage deposit which line the shores of the city;

Now, therefore, this is to certify that in accordance with the recommendation of the Chief of Engineers, the Secretary of War hereby gives unto said Sanitary District of Chicago permission to increase the flow through the Chicago River from 250,000 cubic feet per minute to 350,000 cubic feet per minute until the 31st day of March, 1903, after which date it shall be reduced to 250,000 cubic feet per minute, as now autl rized, upon the following conditions:

* * * * *

Exhibit 12, Doc. 24, Trans. 303.

Permit of January 17, 1903.

2. That the total diversion of water from Lake Michigan through the Chicago River into the Illinois River shall be no greater than already authorized by past War Department permits:

Exhibit 12, Doc. 28, Trans. 312.

Permit of September 11, 1907.

(d) The amount of water withdrawn from Lake Michigan, through the Chicago and Calumet Rivers together, shall not exceed the amount of 250,000 cubic feet per min-

ute (4,167 cubic feet per second) already authorized to be withdrawn through the Chicago River alone.

Exhibit 12, Doc. 37, Trans. 365.

Permit of June 30, 1910.

And whereas, in the judgment of the Secretary of War, an annual average diversion of more than 8,500 cubic feet per second should not now be permitted;

Now therefore, this is to certify that, upon the recommendation of the Chief of Engineers, the Secretary of War, under the provisions of aforesaid statute, hereby authorized the said Sanitary District of Chicago to divert from Lake Michigan, through its main drainage canal and auxiliary channels, an amount of water not to exceed an annual average of 8,500 cubic feet per second, the instantaneous maximum not to exceed 11,000 cubic feet per second, upon the following conditions:

Exhibit 12, Doc. 45, Trans. 433.

Permit of March 3, 1925.

The respondent answered, denying or belittleing each allegation, denying that the Calumet River was navigable within the meaning of the term, or that diverting water from Lake Michigan would lower its level, or that the Act of March 3, 1899, was applicable or even a constitutional or valid enactment. At the same time the respondent claimed the project would benefit navigation; that State law required it to carry out the project; that it was the only authorized agency for providing the needed drainage and sewerage, and the proposed method was the only lawful one under state enactment; that it made application to the Secretary of War for a permit only as a mere matter of comity; and that the old Illinois and Michigan canal laws constituted authorization by Congress. This answer was filed March 23, 1908.

Exhibit 1-G, Trans. 410-11.

Report of Major Putnam, U. S. District Engineer, November, 1923.

(40) Defendant has never recognized the right of the United States in any manner to interfere with the construction, operation or use of its main channel, adjuncts or additions, or the right of the United States to determine or direct how the said main channel and its appurtenances should be operated or use, or the amount of water that should be abstracted from Lake Michigan through its various adjuncts or channels, to carry out the purposes of said Act of May 29, 1889. Application for permits mentioned and described in the bill of complaint and in this answer, were made by two governments, namely, the Government of the State and of the United States. The defendant desired, if possible, to obtain the consent of the Secretary of War for the construction, operation and use of its works, but defendant never has admitted and does not admit, but on the contrary denies the right of the United States to determine the amount of water that should be caused to flow through said main channel or its adjuncts.

Par. 40, Answer, Sanitary District of Chicago in *Sanitary District of Chicago vs. United States of America*, 266 U. S. 405.

114. Diversions for water-supply and sewage purposes have already been discussed and, with the exception of the diversion of the Chicago sanitary district, they have been disposed of. We, therefore, revert to this important permanent diversion at Chicago. The case is so well known and the information in the report so full as to call for little further discussion of its merits. Granting that disposal by dilution was the most practicable plan at the time of its adoption, the fact remains that the Chicago sanitary district has for practically 20 years been on notice that the United States was unwilling to allow the district to divert more water than the limit set in the permit of 1903, namely, 4,167 cubic feet per second. Notwithstanding this, the district has since then greatly expanded its boundaries and enlarged its plans, and from year to year, in the face of the opposition of the United States, has diverted more and more water, until in 1917 the yearly average diversion

was 8,800 cubic feet per second, which is more than twice the lawful amount.

115. The district can no longer fairly plead the absence or the impracticability of other safer methods of handling sewage and of protecting its people from water-borne diseases. Certainly, for the past 20 years, expert opinion has held disposal by dilution to be inferior to other methods of treating sewage, and enlightened public opinion has condemned a policy which, in effect, is the transfer of a nuisance from our own front door to that of our neighbor. Large cities on the Great Lakes cannot safely drink raw lake water, nor should they discharge unscreened and unfiltered sewage either into the lakes or into tributary streams. In 1915, the Chicago Real Estate Board employed three experts, of whom two were of acknowledged eminence in England, and the third a New York expert of well-known authority, to investigate the sewage problem of Chicago and to present their views as to the best way of solving it. Their report entitled "A Report to the Chicago Real Estate Board on the Disposal of the Sewage and the Protection of the Water Supply of Chicago, Illinois," by Messrs. Soper, Watson, and Martin, has been printed, and its conclusions are, therefore, well known to the public in general, and particularly to the people of Chicago whom they advised substantially in accordance with the views above expressed. Chicago is, therefore, debarred from any claim for indulgence as to work done and expenditures incurred in recent years. If, in defiance of the opposition of the Government, and in open disregard of the law, the officials of the Chicago Sanitary District have continued to expend the money of their constituents in the prosecution of unwise and illegal plans, these officials and their constituency are to blame, and they should expect no great indulgence from the general public whose government they have ignored and whose interests they have disregarded.

Exhibit 3, p. 55.

Exhibit 210, Trans. 9246.

Warren Report, Recommendation,
Chief of Engineers.